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OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT

HARVARD COLLEGE, IN CAMBRIDGE.

VOL. IV.

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VOL. IV.

THE TERRESTRIAL

AIR-BREATHING MOLLUSKS

OF THE

UNITED STATES AND THE ADJACENT TERRITORIES
OF NORTH AMERICA.

DESCRIBED AND ILLUSTRATED

BY W. G. BINNEY.

VOL. V.

CAMBRIDGE:
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JULY, 1878.

PREFACE.

ALTHOUGH this work forms a fifth volume to the "Terrestrial Mollusks of the United States,"* I have endeavored to make it a complete manual of the subject. With this view, I have compiled from the writings of my father, my friend Mr. Bland, myself, and other authors all their more important portions, not only of descriptions and figures of species, but of all that relates to the Habits of the Animals, their Geographical Distribution, their Jaw and Lingual Membrane, their Anatomy, and their Classification. I devote no space to Bibliography, referring to my general work on that subject published by the Smithsonian Institution.

In the descriptive portion it will be seen that I have usually adopted the descriptions of genera and subgenera of Albers and Von Martens. From the same authors I have also usually adopted the generic and subgeneric names, without inquiry into their precedence, having neither time nor inclination to attempt myself to disentangle the confused synonymy.

In the synonymy of the species I have quoted only authors giving an original description or an original figure. I have personally consulted all the references, unless otherwise specified.

The subject is brought down to January, 1878. The plates of Vol. III. are reproduced. Those of Vols. I. and IV. I regret not being also able to give. In the references to plates in the text it must be remembered that figures of shells are included in the copperplates of Vol. III., while those of genitalia and lingual dentition are to be found exclusively in the lithographic plates now first offered. Thus there is a double system of plates.

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* The Terrestrial Air-breathing Mollusks of the United States and the adjacent Territories of North America: described and illustrated by Amos Binney. Edited by Augustus A. Gould. Boston, Charles C. Little and James Brown. Vols. I., II., MDCCCLI.; Vol. III., Plates, MDCCCLVII.; Vol. IV. by W. G. Binney, New York, B. Westermann, MDCCCLIX., from Boston Journal of Natural History, Vol. VII.

In addition to those mentioned in the first and fourth volumes, I am indebted for assistance in the preparation of this to Dr. J. G. Cooper, Haywood, Alameda County, Cal.; Miss Annie M. Law, Philadelphia, Tenn.; Mr. W. G. Mazyck, Charleston, S. C.; Prof. A. G. Wetherby, Cincinnati, O.; Mr. O. B. Johnson, Forest Grove, Or.; Mr. Henry Hemphill, San Diego, Cal.; Mr. Sam. Powell, Newport, R. I.; Mr. G. W. Tryon, Philadelphia, Penn.; Mr. F. Stein, Mt. Carmel, Ill.; Mr. H. S. Crooke, N. Y.; Mr. A. T. E. Lansing, Watertown, N. Y.; Mr. R. E. C. Stearns, San Francisco, Cal.; Dr. W. H. Dall, Washington, D. C.; Mr. W. W. Calkins, Chicago, Ill.; Mr. J. Gwyn Jeffreys, London; Mr. R. M. Byrnes, Cincinnati, O.; Mr. Anson Allen, Orono, Me.; Mr. A. W. Crawford, Oakland, Cal.; Mr. Arthur F. Gray, Danversport, Mass.; Mr. Charles Dury, Cincinnati, O.; Dr. C. A. Millar, Cincinnati, O.; Mr J. T. Crans, Indianapolis, Ind.; Miss Lizzie Taylor, St. Paul, Minn.; Dr. L. G. Yates, California; Mr. J. Matthew Jones, Halifax, N. S.; Mr. E. Ingersoll, Jersey City, N. J.; Mr. W. G. W. Harford, San Francisco, Cal.; Dr. J. B. Elliott, Sewanee, Tenn.

To Mr. Bland I am indebted for a continuation of the kindness which has so greatly aided me during more than twenty years.

W. G. BINNEY.

Burlington, N. J., June, 1878.

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TERRESTRIAL AIR-BREATHING MOLLUSKS OF THE UNITED STATES.

I. HABITS AND FACULTIES.[1]

THE animals of this order, indigenous to the United States, are essentially inhabitants of the forest. It is there, under the deep shadows of a dense foliage, where the sun's rays hardly penetrate to the surface of the earth, and where the ground is covered with the mouldering trunks of trees and thick layers of decaying leaves, that they find a constant moisture, a twilight interrupted only by darkness, abundance of vegetable and animal food, and the means of shelter and protection. These constitute a combination of circumstances very favorable to their increase, and hence they may be discovered, in situations where these conditions exist, in every part of the country where they can be found at all. But when, with these, are conjoined a mild climate and a calcareous soil, the maximum of favoring influences is reached, and large numbers are produced. It is in the great valley of the Mississippi, based throughout nearly its whole extent upon horizontal limestone formations, that these combined causes operate over an extensive region, and there, consequently, the species proper to it exist in multitudes. In the parts of the country which have been long cultivated, and are nearly deprived of their forests, they have mostly disappeared, and only survive in places where some shelter of wood or stones is still afforded to them. They everywhere avoid cultivated fields and open pastures, and are never found in gardens,[2] or about or within houses or other buildings, excepting in cases where specimens have been accidentally introduced and remaining undisturbed have multiplied into a colony. In this respect they present a remarkable contrast to some of the same animals in Europe, which not only are very common in open and cultivated tracts, but are particularly numerous in fields and gardens, where some of the species commit much mischief, and in cellars, drains, and other similar situations, in immediate contiguity with man. The species which have been introduced from Europe, and naturalized in this country, are distinguished by the same habits as the stock from which they are derived, and differ as much from the native species. Thus, *Tachea hortensis* lives in open and exposed situations destitute of shelter, except that afforded by grass and shrubs; *Zonites cellarius* occupies gardens and cellars; *Limax flavus* inhabits cellars and damp places about drains; and *L. agrestis* is common everywhere in gardens, fields, cellars, and houses. It infests the roadside, and the neighborhood of our dwellings, and has in some places become the pest of the horticulturist.

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[1] I have reproduced Chapter X. of Vol. I., adding to and modifying it in several particulars when required by my more recent experience and investigations.

[2] I have in the text already modified this assertion of my father. The instance he gives in his note of "an exception to this remark in *Helix fallax*, Say (= *Hopetonensis*), which we observed a few years since living in great numbers in gardens in Charleston, S. C., in company with *Bulimus decollatus*," is by no means single. In every country town and even city some species is sure to be found numerous in gardens and especially in cemeteries, and once having gained a foothold bids fair to retain it. In Burlington, N. J.

Whether this difference of habitat arises from original constitution, or is the consequence of the long-continued operation of external causes, is a curious subject of inquiry. The preference for the forest over the open country exhibited by the native species, even in situations where both have been for a long time equally accessible to them, seems to indicate that the former supposition is correct; and this opinion is strengthened by the disappearance of nearly every species with the progress of agriculture. If their habits were not insuperable, they might be expected to have been somewhat modified ere now, and to have become adapted to the new physical conditions to which they are subjected. That they have not been, suggests the thought that, like the aboriginal race of men, and some of the larger quadrupeds, they are destined to give way before the advance of civilization, and to have their places filled by foreign species. On the other hand, there are some facts which tend to show that accidental causes may have produced a slow and gradual revolution in the habits of the European species, corresponding with the changes, which, within the historical period, have taken place over the surface of the greater part of Europe; and that in process of time the same influences will produce similar results on the habits of the North American species. All those parts of Europe which are now the most

the most common species is *Patula alternata*, *Zonites arboreus*, and *Limax campestris*. In Savannah it is *Triodopsis appressa*; in Norfolk, Va., it is *Mesodon albolabris*; in Macon. Ga., it is *M. major*. The original introduction was no doubt accidental.

populous were covered with forests at no very distant period, and all the terrestrial mollusks were then, like ours at the present time, living in the forest. The progress of agriculture there was very slow compared with its advances in this country, and thus time was given to the animals to accustom themselves to the change ; and they have thus, by slow degrees, adopted their present habits.[1] In the United States the advance of agriculture in newly settled parts is very rapid ; large tracts of forest are almost simultaneously subjected to the axe and to fire, and a very few years produce an entire change in the vegetation of a whole section. Consequently these animals are at once exterminated, or the few that survive are brought suddenly under the influences of new circumstances, which, from the abruptness of the change, are fatal to them, but which, if imposed upon them more gradually, might have been sustained. A few spots and some limited tracts of land, remaining unchanged in the midst of cultivation, protect some individuals of every species ; and it is from this comparatively small number, thus preserved, that their subsequent increase is derived. But at this period the field is equally open for the multiplication of those foreign species which accompany man as for the native species, and it is not surprising that the former, whose habits are already adapted to the existing state of things, should increase more rapidly than the latter. The native species, however, become gradually familiarized with the circumstances around them, and some few of them advance, and after a time establish themselves in the open country, where they seek such shelter as they can find. This transition is very slow, but there are sufficient indications, in the exceptions which are found to the general habits of the species in this particular, to show that it is going on ; and therefore it is reasonable to believe that when a period shall have elapsed as long as that since the south and west of Europe were covered with forests, our species will have become able to sustain themselves in the open country, and will have spread themselves in great numbers over those populous parts where they are now wanting. The power of adaptation to new circumstances, which is a prominent quality of nearly all the shell-bearing species of this order, and which, combined with a remarkable tenacity of life, enables them to resist successfully the many dangers to which they are exposed, is illustrated in the extremes of their mode of life on the two continents. We know of no other instances of animals living in a natural condition, not domesticated nor accompanying man, where the same diversity of habitat in analogous species exists. The presumption of changes which shall approximate the habits of both, in proportion as the physical circumstances of both approach each other, is therefore not a violent one. But it is by no means certain that all the species will survive the violent change to which they are at first exposed. Those of them which are in a state of decline and nearly run out, and those which are strictly local in their habitats, will be least able to sustain themselves, and their entire extinction will be very likely to follow.

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[1] I am not able to state whether the European snails are, as a class, similar in their habits to *Tachea hortensis,* or whether many of them may not be restricted to the forests, as ours are.

All the species are nocturnal or semi-nocturnal in their habits. In the daytime they seek such shelter as may be at hand, and retreat into dark holes and crevices, or hide themselves under the fallen trunks of trees, fragments of wood, leaves, and stones, or bury themselves wholly or partially in the earth. There they remain inactive until evening twilight, when, except in seasons of drought, they sally forth in numbers; and in favorable situations, such as ravines and low places in the forest, may be seen crawling over the surface of the ground, and sometimes climbing the stalks of plants and the trunks of trees. They are probably active during the whole night, in which time they all seek their food, and those species which are noxious to man commit their depredations in the garden and orchard. At this time, too, their sexual meetings take place. Soon after daylight they retire to their retreats, and remain very close until night approaches again. They also come forth when the atmosphere is charged with moisture, and after light showers.

There is a difference in the places of their retreat. The naked genera are oftenest found attached to the lower surface of wood and stones lying in contact with the ground, or to the damp walls of cellars, and, in the forest, concealed under logs. So soon as, from the increased dryness of the atmosphere, these places no longer retain moisture, they abandon them for others, and in seasons of drought they penetrate deeply into the earth. The shell-bearing genera, in the forest, are observed under prostrate timber, to the lower surface and crevices of which they adhere by a mucous attachment during the day, in hollows under the roots of trees, and under the layer of decaying leaves which cover the ground. In situations where such places of shelter are not found, they half bury themselves in the soil, at the roots and under the shade of thick tufts of plants. Numbers frequently resort to the same retreat, but this in the shell-bearing genera seems a mere matter of accident, while in the introduced species of *Limaces* it appears to indicate a gregarious habit, as they prefer to crowd together and lie in close contact with and upon each other.[1] These last are said by some to occupy permanently the same retreat, but the assertion is probably incorrect. They often, and perhaps generally, remain in the immediate vicinity of the place where they procure their food, and hence they often resort to the same place of shelter; and as many of them have frequently been observed in the same place, they have been thought to be the same individuals. But when one set of individuals is destroyed, another soon takes their place, and whenever a new shelter is provided, by the accidental presence of fragments of wood in suitable situations, it is immediately resorted to by them. The native genus *Tebennophorus* is in no manner gregarious; it lives in the forest, mostly buried in decaying and rotten wood, and no more than two are usually found together. In cloudy weather, when the atmosphere is charged with moisture, and during light showers, all the species come forth in the daytime; but on a change of weather immediately return again, and during rains remain in their retreats. Long-continued or excessive rains, however, inundate their hiding-places, drive them out, and force them to resort to trees.

We have seen, in a preceding part of this work,[2] how numerous are the agencies which are continually tending to destroy the lives of individuals, and to exterminate whole species. Being all of them slow in their motions, without means of escape from enemies, destitute of instruments of offence or of defence, and some of them unprovided with a covering, it would seem as if their existence must be very precarious, and that they must be easy victims to the unfavorable circumstances around them. Such would be the case undoubtedly, and these causes would interfere with the diffusion of species and derange their distribution in a greater degree than they actually do, if there were not counteracting properties in the animals themselves which modify and limit the destructive tendency. These conservative properties are, their prolific generative capacity, their insensibility to pain, their extreme tenacity of life, and their extraordinary power of reproducing important organs which have been cut off or destroyed by accident.

[1] The promiscuous mingling of individuals of *Limax agrestis* and *Limax variegatus* in their respective retreats has often reminded us of the familiar positions in which swine place themselves for sleep.

[2] See I. 132 *et seq.*

The number of eggs produced varies in the genera and species in the same proportion as the dangers to which they are exposed are greater or less. Thus, in the naked genera, whose means of protection and whose chances of preservation are much less than of those protected by an external shell, the number is much greater than in the latter. The number of eggs produced by two individuals of *Limax agrestis* kept in confinement by Dr. Leach was, in the course of rather more than a year, seven hundred and eighty-six. It usually amounts to at least three hundred per annum. The other species, though not equally prolific, multiply greatly; and each pair of the various shell-bearing species produces, annually, from thirty to one hundred eggs, and perhaps more. The young of the *Limaces* complete their growth and reproduce their kind sometimes within the year of their birth, and always as soon as the second year; and the species of the other families are believed not to require a much longer time to attain maturity. This rapid increase replaces the numbers annually destroyed, and maintains the species in their relative importance.

Their extreme tenacity of life is manifested in every stage of growth, from the egg to the mature animal. The eggs of *Limax* have been so entirely desiccated that their form has disappeared, and there remained only a thin skin, friable between the fingers. In this condition they have been kept for years; and yet a single hour's exposure to humidity was sufficient to restore their form and elasticity.[1] They have been dried in a furnace eight successive times, until they were reduced to an almost invisible minuteness, yet in every interval have regained their original bulk in a moist situation.[2] In all these instances the young have been developed in the same manner as in other eggs not subjected to the experiment. In the northern part of the United States we have frequently observed the eggs of the shell-bearing genera in the forest covered with snow, protected only by a single leaf, where they had remained through the winter months, constantly exposed to a temperature much below the freezing-point. The shell-bearing species themselves withstand the cold of the severest winters in the same situations; and *Succinea* has been frozen in a solid block of ice, and yet escaped unharmed. *Helices*, when frozen in a state of confinement, though they sometimes recover so far as to move about with some activity, usually survive but a short time.

The power of reproduction of parts of the body is more astonishing still. It is well established by experiments on thousands of *Helices*, that the eye peduncles, when cut off, grow out again, — that considerable parts of the locomotive disc may be amputated, and the new parts immediately bud out, and supply their place. The great length of time they can subsist without food is another exemplification of their great tenacity of life. Those species, especially, which live in dry and exposed situations have this power of endurance to a remarkable degree. A friend received specimens of *Helix desertorum* which had been collected in Egypt, had been shipped to Smyrna, thence to Constantinople, thence to Rio Janeiro, and finally to Boston, — occupying a period of about seven months, — which appeared in full vigor when taken from the papers in which they had been enveloped. They were laid away in a drawer; and on being examined three years afterwards, some of them still came out in tolerable vigor.

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[1] Bouchard-Chantereaux.

[2] Leuchs.

As stated above, the shell-bearing genera live mostly in the forest, sheltered under the trunks of fallen trees, layers of decaying leaves, stones, or in the soil itself. In these situations they pass the greater part of their lives. In the early days of spring, they sometimes assemble in considerable numbers, in warm and sunny situations, where they pass hours in indolent enjoyment of the warmth and animating influence of the sunshine. Whether these meetings serve any useful purpose in the economy of the animal, or are caused by the pleasurable sensation, and renewed strength derived from the warmth of the situation after the debility of their winter's torpidity, is uncertain; it is probable, however, that they precede the business of procreation. It is certain that they last but a short time, and that after early spring the animals are to be found in their usual retreats.

In the course of the months of May or June, earlier or later, according to the locality and as the season is more or less warm, they begin to lay their eggs. These are deposited, to the number of from thirty to fifty, and even more, in the moist and light mould, sheltered from the sun's rays by leaves, or at the side of logs and stones, without any order, and slightly agglutinated together. The depth of the deposit is usually measured by the extreme length of the animal, which thrusts its head and body into the soil to the utmost extent, while the shell remains at the surface; but sometimes the animal burrows three or four inches deep before making the deposit, in order to insure a sufficiently moist position. Three or four such deposits, and sometimes more, are made by one animal during the summer and autumn. When the deposit is complete, it is abandoned by the animal. The eggs vary in size according to the magnitude of the species producing them. They are nearly globular, one axis being somewhat longer than the other, white and opaque. They consist, in general, of an external, semi-calcareous, elastic membrane investing the whole, the interior surface of which is usually studded with numerous rhombic, microscopic crystals of carbonate of lime, some species, however, having a hard enveloping calcareous shell, of the consistence of that of a bird's egg ; of an inner thin, transparent, shining membrane which immediately encloses a transparent and somewhat viscid fluid, analogous to the albumen of birds' eggs ; of the albumen itself, and of the vitellus, which, possessing the same degree of transparency as the albumen, cannot be distinguished from it at this time. The elastic eggs, when first laid, are often flaccid, and seemingly only half full of fluid, but they soon absorb moisture and become distended. The embryo animal, with its shell, is observable in the albuminous fluid in a few days after the egg is laid. Its exclusion takes place, under ordinary circumstances, in from twenty to thirty days, according to the state of the atmosphere. Warmth and humidity hasten the process, while cold and dryness retard it to an almost indefinite extent. The hatching of eggs laid late in the autumn is often interrupted by the approach of cold weather and of snow, and delayed until the next spring. In some few species the young is hatched from the egg before exclusion.

The young animal gnaws its way out of the egg, and makes its first repast of the shell which it has just left. It consists at first of about one and a half whirls, the umbilicus being minute, but open. Its growth is rapid, and it has usually increased in magnitude three or four times, before the close of the first year.

In the month of October, or at the epoch of the first frost,[1] the snail ceases to feed, becomes inactive, and fixes itself to the under surface of the substance by which it is sheltered, or partially burrows in the soil, and with the aperture of the shell upward, disposes itself for its annual sleep or *hibernation.*[2] Withdrawing into the shell, it forms over the aperture a membranous covering, consisting of a thin, semi-transparent mixture of lime mucus or gelatine, in some species opaque and thick, secreted from the collar of the animal. This membrane is called the

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[1] In Florida some species continue active during the whole winter.

[2] The same process is adopted by the species of the Pacific Region to protect themselves from the effects of the dry season.

epiphragm. It is formed in this manner : The animal being withdrawn into the shell, the collar is brought to a level with the aperture, and a quantity of mucus is poured out from it and covers it. A small quantity of air is then emitted from the respiratory foramen, which detaches the mucus from the surface of the collar, and projects it in a convex form, like a bubble. At the same moment the animal retreats farther into the shell, leaving a vacuum between itself and the membrane, which is consequently pressed back by the external air to a level with the aperture, or even farther, so as to form a concave surface, where, having become desiccated and hard, it remains fixed. These operations are nearly simultaneous, and occupy but an instant. As the weather becomes colder, the animal retires farther into the shell, and makes another septum, and so on, until there are sometimes as many as six of these partitions ; the circulation becomes slow ; the pulsations of the heart, which in the season of activity vary from forty to sixty in a minute, according to the temperature of the air, decrease in frequency and strength, until they at length become imperceptible ; the other functions of the body cease, and a state of torpidity succeeds, which is interrupted only by the reviving heat of the next spring's sun. During the months of April or May,[1] on the accession of the first warm weather of the season, the animal breaks down and devours the membranous partitions, and comes forth to participate in the warmth and freshness of the season. At first it is weak and inactive, but, recovering in a short time its appetite, resumes its former activity. The peculiar epiphragm of *Binneya* is described when treating that genus.

The season of hibernation continues from four to six months. The final cause of this extraordinary condition is undoubtedly to enable the animal to resist successfully the extreme reduction of temperature, and to survive through the long period when it must, in northern climates at least, be entirely destitute of its usual food. With a view to the first purpose, a place of shelter is provided, and the aperture of the shell is hermetically sealed by the epiphragm or the hibernaculum ; for the second, the state of torpor is adopted, during which the functions of digestion, respiration, and circulation being suspended, and all the secretions and excretions having ceased, there is no drain upon the strength and vitality of the animal, and no exhaustion of its forces. Hence it comes forth, at the end of the period, in much the same condition in which it commenced it, and resumes almost immediately its usual functions and habits. So entire is the cessation of the function of respiration, that the air contained between the epiphragm and the animal is found to be unchanged. The circulation, however, may be partially restored by a small degree of heat, the warmth of the hand being sufficient to stimulate the heart to action.

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[1] In New England, earlier in more southern latitudes.

The snails pass the greater part of their lives under dead leaves and logs, under stones, or burrowing in the ground. They seldom come from their lurking-places while the sun shines, and indeed are never seen ranging in the daytime unless the day be damp and dark. Should they then be surprised by the appearance of the sun, they immediately take shelter from its rays, under some cover or on the shaded side of the trunks of trees.

Their natural food is vegetable; and the formation of the mouth and the organs with which it is armed seems to be peculiarly well adapted for cutting fruits and the succulent leaves of plants. The lower edge of the jaw being applied against the substance to be eaten, the semilunar rough instrument, which has been called the lingual membrane, is brought up against it, cutting out and carrying into the mouth semicircular portions of nutriment. This operation is carried on with great rapidity, and the substance to be eaten soon disappears. It is certain, however, that some species[1] are also fond of animal food, and sometimes prey upon earthworms, their own eggs, and even upon each other; but the slowness of their motions and their consequent inability to pursue prey forbids the idea of their being dependent on animal food. They, in their turn, become the prey of various birds and reptiles; and it is no uncommon thing to observe, in the forest, clusters of broken shells lying on logs or stones which have been chosen by birds as convenient places for breaking the shell and extracting the animal.

The snails of the United States are for the most part solitary in their habits, differing very much, in this respect, from the snails of Europe. It is true that in localities favorable for their residence they may be collected in considerable numbers; and especially is this the case in the States north of the Ohio River. But even there they seem to live independently of each other, and not to unite into herds or communities. There are occasional exceptions, however, as in the case of *Patula alternata*, very large numbers of which have been observed collected into a small space, especially in winter, as if for the purpose of imparting warmth to each other. The few species of European snails which have been introduced retain their native habits. *Tachia hortensis*, for instance, which has been transplanted to some of the small islands in the vicinity of Cape Ann, is found there in countless numbers, literally covering the soil and shrubs. It is worthy of notice, also, that each island is inhabited by a variety peculiar to itself, showing that the variety which happened to be introduced there has propagated itself, without a tendency to run into other variations. Thus, on one islet we have the yellowish-green, unicolored variety, once described as *Helix subglobosa;* and on another, within a very short distance, we find a banded variety, and none others.

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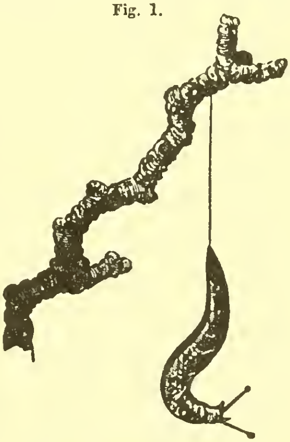
[1] These are characterized by the lingual dentition. See *Glandina*.

In regard to colors, our snails are quite plain and exceedingly uniform ; in this respect, also, differing essentially from the species of the Old World. They vary from yellowish-green through horn-color to chestnut, most of them being simply horn-colored. This is perhaps owing to the fact that our species do not infest our gardens and open fields, but are generally confined to forests, sheltered under logs and stones, and are rarely seen abroad except during twilight or on damp and dark days ; indeed, they almost entirely disappear as the forests are cut down, and seem to flee the approach of man. The European species, on the other hand, follow in the track of cultivation, and are common in gardens and fields, on walls and hedges, and other places exposed to the action of light. With the exception of *Patula alternata* and *Hemitrochus varians, Liguus fasciatus*, etc., there is scarcely a species having bands or variegated colors inhabiting eastern North America ; and even these latter species can scarcely be regarded as an exception, as they are only to be found at the southern part of Florida, and are more properly West India shells. In Texas, and beyond the Sierra Nevada and Cascade Mountains in Oregon and California, many of the species have one or more bands.

Another peculiarity of the American snails is the toothlike appendages with which the aperture of a large proportion of them is armed, and which are characteristic of the group designated by Férussac under the name *Helicodonta.* More than one half of the whole number, and more than three fourths of those with reflected peristome, are thus provided. In some species these appendages assume the form of folds rather than teeth ; and in others we have simple threads or laminæ revolving within the aperture in the course of the spire. They are not formed until the shell has attained its full growth.

The genera not furnished with an external shell are more especially nocturnal than the other families of the order, and they are so rarely visible in the daytime that thousands may be near without being known. The injury which they commit in kitchen-gardens, for this reason, is often vaguely ascribed to worms or to birds; and no measures are taken against the real culprits. Their habits, in general, coincide with those which have been described as distinguishing the order; and we shall therefore mention here only those which are peculiar to them. They differ from the other families in not possessing the faculty of hibernation, or suspension of their organic functions during the cold season. In temperate latitudes the snails hibernate, under all circumstances, on the approach of cold weather; the slugs, on the contrary, having the power of resisting extreme cold, continue in their usual haunts until severe frosts set in, when they retire into the earth and other sheltered retreats. Here they remain in a state of inaction and partial torpidity; the functions of the body, however, still going on, though slowly and with diminished force. A slight increase of heat arouses them and stimulates their organs to renewed action, and they accordingly often come abroad in mild weather, even during the winter. Those which inhabit cellars and other protected situations are in motion throughout the year; and individuals of all the genera and species which we have kept in confinement have continued active, fed freely, and increased in size as much in the coldest months as in the summer. All the species which have yet come under our notice possess the power of suspending themselves in the air by a gelatinous thread. This they effect by accumulating a quantity of tenacious mucus at the posterior extremity of the foot, which they attach to the object from which they are to commence their descent; then, loosing their own hold, they hang suspended by this point. Continuing the secretion, their own weight attenuates the mucous attachment, and draws it out into a thread. As this dries and hardens, a fresh supply is afforded, the thread is lengthened, and the animal lets itself down any desirable distance. At this time, also, the margin of the foot pours out mucus freely, and during the whole operation the locomotive disk is in active undulatory motion, in the same manner as when in ordinary progression. It appears in this way to guide and force towards the extremity the mucus which is secreted on its surface, and which, collected at its extreme point, forms the thread. The slug often pauses in its descent, and extends its eye-peduncles and its whole body in various directions, as if seeking some object on which to make a lodgment. The faculty of suspending themselves in this manner indicates that they pass some part of their lives on trees, from which they can thus make a convenient descent to the earth; there are some species, indeed, which are stated to inhabit trees almost exclusively. It may serve also as a means by which they can suddenly escape from the attacks of their enemies, and particularly of birds. It is mostly, however, when they are young, or at least not grown to their full size, that they enjoy this power. Those which have attained their extreme dimensions and weight are too heavy to trust themselves to so frail a support. They have no power to elevate themselves again, and in this respect are inferior to the spiders, which can both lower and raise themselves by the aid of the secreted thread. Like the spiders, however, they often remain suspended in mid-air for a time, and it is not unlikely that there is some pleasurable sensation connected with the act, which induces them thus to prolong it. We have seen the descent actually practised by every one of our Atlantic species, as well as by the large Pacific *Ariolimax.* Besides the watery fluid which at all times lubricates the integuments, the animals can, at their will, secrete at any point, or over the whole surface of their bodies, a more viscid and tenacious mucus than is usually exuded. This power is used as a means of defence. Whenever a foreign substance touches them, immediately a quantity of this mucus, of the consistence of milk and nearly of the same color, is poured out and forms a kind of membrane interposed between themselves and the irritating substance. So, also, when they are surrounded by a corrosive gas, or are thrown into water or alcohol, they form over themselves in this way a thick protecting covering, which is undoubtedly a non-conductor of heat and impervious, at least for a time, to liquids. Shielded by this coating, they can live the greater part of a day immersed in water, and for a shorter time in alcohol; and M. Férussac asserts that they have survived for hours in boiling water. They leave a trace of their usual secretion on every object over which they pass, and thus can easily be traced to their retreats. The ordinary secretion is most abundant at their posterior extremity. The secretion of the mucous fluid over their surface is necessary to their existence. Death

Fig. 1.



Limax campestris, suspended.

immediately follows the failure of this power, and is preceded by the drying up of the skin. All the species are extremely voracious, and devour an incredible quantity of food in a short time. Those found in this country are generally supposed to be vegetable feeders, but nearly all of them subsist occasionally upon dead animal matter, of which they seem to be fond, and when in confinement sometimes attack and devour each other. It is probable, therefore, that in their natural condition, all of them at times resort to animal food, and devour earthworms, insects, and their larvæ, and such other animals as, inhabiting the same retreats, are like themselves slow of motion and defenceless. It is certain, however, that the principal food of those species which frequent the neighborhood of houses and gardens consists of the tender leaves of succulent plants and of ripe fruits. Upon these, in Europe, they perpetrate serious ravages, often destroying in a night the labors and hopes of the gardener, and in some years committing so much injury, and interfering to such a degree with the prosperity of the agriculturist, that they are ranked among the scourges of the country. Like caterpillars, locusts, and rats, they are considered to be perpetual enemies, and a war of extermination is carried on against them. To limit the extent of the evil, many remedies have been proposed, and among others the prayers and exorcisms of the church have been claimed, but without any considerable abatement of it. Happily, we are not in this country subject, in the same degree, to the mischief done by these animals, for their excessive increase is kept in check, probably, by the vicissitudes of the climate ; but it may be useful to know that a border of ashes, sand, or sawdust, laid around the bed containing the plants it is desired to protect, will prove an impassable barrier to the slugs, so long as these substances remain dry. When the slugs attempt to pass the barrier, they become entangled in the dry ashes or sand, which envelops them entirely. The particles of these adhere to the viscid surface of the animals, who, in vain endeavoring to disengage themselves from them by secreting new mucus, at length become exhausted and die.

The growth of the slugs is remarkably rapid. We have known the young to double their size and weight in a week. The earliest hatched young of the season generally attain their full maturity before the end of the first year, although they may afterwards increase somewhat in bulk. Those which leave the egg at a later period mature during the second year. Individuals kept in confinement and fully fed reach a much greater size than when in their natural condition.

The slugs possess, in a remarkable degree, the power of elongation and contraction of the body. When fully extended, it is long, narrow, more or less cylindrical, and generally terminating in a sharp point. The carina of the carinated species disappears. The head is protruded far beyond the mouth; the eye-peduncles are long, slender, and graceful. The mouth is changed from an oval to an elongated form, with parallel sides and rounded ends. The glands are lengthened, lose their prominence, and appear nearly smooth. But when alarmed by the touch of a foreign substance, an instant change occurs, and a sudden contraction takes place. The eye-peduncles and tentacles are retracted and the head is drawn under the mantle. The anterior edge of the mantle is brought to the level of the foot, and its form becomes nearly circular. The body is shortened to one fourth of its former length, and tumid; the back is rounded and rises high in the centre, and the skin is rough with prominent glandular protuberances. The carina, when it exists, becomes conspicuous. This is the form which they assume in their retreats when they retire to protect themselves from the effects of drought and cold. It differs so much from their form when in motion, that one not well acquainted with them would hardly recognize the same animal in its new shape. It is among the *Limaces*, perhaps, that the change is most striking, and the difference of form between the extremes the greatest.

The slugs commence reproducing their kind as early as the end of the first year, before they have attained their full dimensions, and hence the eggs of the same species often vary considerably in size. These are deposited in a cluster of thirty, or thereabouts, in the soil and in other moist and protected situations; or if the species be one that frequents houses, then in the crevices or corners of the walls or under the decaying planks of cellars. In general form and appearance they resemble the eggs of the shell-bearing genera, but differ from them in several important particulars. The eggs of the snails are all opaque, while those of the slugs are more or less transparent, permitting, in the *Limaces*, a view of the cicatricula, and affording an opportunity of observing its developments. Those of the former are all deposited free, or unconnected, except by a slight agglutination; those of the latter, in some of the species, are connected together by a prolongation of the outer membrane at their longest diameter, thus forming a sort of rosary. In other species they are deposited in a mass. The deposits of eggs, when made, are abandoned by the slug, who then removes to some other convenient place. A considerable number of separate deposits are made during the year.

The slugs and some species of snails were considered by the Romans to possess medicinal properties, and this belief continued, among the nations of Europe, through the Middle Ages down to comparatively recent times. There is hardly a disease, internal or external, of man or the domestic animals, in which, according to the statements of authors, they have not proved beneficial; and the relations concerning them are numerous and truly marvellous. The testaceous rudiment of the *Limax* acquired in this respect a pre-eminence above the animal itself, and enjoyed a high rank among the numerous bezoars and amulets which were supposed to protect the body from evil influences, and to impart health and activity to its various functions.[1] The accounts of their virtues, copied from one author to another, on the authority of names, show how easily error is perpetuated, and how difficult it is to eradicate from the public mind a false opinion which has once obtained a footing. A full relation of all the absurdities which gained credence would form a curious page in the history of credulity and superstition. The more general diffusion of knowledge at the present day has dispelled these ideas in a great degree; but some relics of them still linger among the rural population of many parts of Europe. In this country no such belief has ever prevailed; and so hidden and clandestine are the habits of the animals, that but a small part of the population is aware of their existence, and those who are familiar with them view them with such feelings of disgust as would effectually prevent their use either as medicine or as food.[2] They have also from very early times been used in the preparation of cosmetics; and the water procured from them by distillation, no longer than two or three centuries ago, was much celebrated and used by ladies, to impart whiteness and freshness to the complexion.

Although the title of this work embraces only the terrestrial genera, I have actually included all the *Geophila*, and thus have been forced to treat *Onchidella*, whose habits are strictly marine. At the same time I have omitted several strictly terrestrial genera which are not air-breathing, but furnished with gills, such as *Helicina*.

[1] As late as the close of the sixteenth century Helling published a dissertation with this title: "Ossiculorum limacum usus in febribus." During the year 1863 a syrup of snails was prescribed to members of my family by two regular French physicians in Paris.

[2] They are, however, frequently imported as an article of food for foreign residents of our cities.

II. GEOGRAPHICAL DISTRIBUTION.

I HAVE already in the "Bulletin of the Museum of Comparative Zoölogy" at Cambridge[1] given as correct an idea of the distribution of our species as was possible. In repeating it here (with such additions and corrections as have been suggested by subsequent investigations), I cannot too strongly urge, in extenuation of its imperfection, the meagreness of the data on which some of my views are founded. I may say with exact truth that California, New England, and the States north of the Ohio River are the only ones which have been thoroughly searched. The species of the rest of the country are known only by the researches of few and widely separated resident naturalists, from the collectors sent by my father, and by collections made by my correspondents while travelling in various sections of the country. The last sources of information are restricted to purely accidental localities. There has been no systematic investigation of vast tracts of intervening country or of some very important points.

The subject must be studied in connection with the chapter on the same subject in Vol. I. (p. 99). I need not add that from the proper sources the student of distribution must have a thorough knowledge of the physical geography of North America.

The limits of the fauna at the South correspond quite accurately with the political limits of the United States. The Mexican fauna has lately been investigated by Messrs. Fischer and Crosse in the exhaustive work on "Les Mollusques Terrestres et Fluviatiles du Mexique et de l'Amérique Centrale." The northern limit of the fauna is formed by climate alone. Thus our limits comprise all the continent of North America, from the extreme north to San Diego and the Rio Grande.

Properly speaking, there are two distinct faunas within these limits, the Pacific and Eastern, with perhaps a third in the Central Basin, but for convenience they are all treated as part of the North American fauna. I have therefore designated these as

I. THE PACIFIC PROVINCE.
II. THE CENTRAL PROVINCE.
III. THE EASTERN PROVINCE.[2]

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[1] Vol. III. No. 9. 1873.

[2] In the work of Wallace quoted below, North America is designated as the Nearctic Region. The subdivisions proposed by him correspond almost exactly with my own

The boundaries of these provinces and the subdivisions which appear to exist in them will be given below, as well as lists of their peculiar species. It must be distinctly understood, however, that future researches, especially at the South and Southwest, may greatly modify the views here presented.

I. THE PACIFIC PROVINCE[1] comprises a narrow strip between the Sierra Nevada and Cascade Mountains on the east, and the Pacific Ocean on the west. Its southern limit is San Diego, from whence it extends northerly into Alaska.

Over the whole of this province the following species range: —

Macrocyclis Vancouverensis.
sportella.
Mesodon Columbiana.
germana.
Arionta tudiculata.
Ariolimax Columbianus.
Prophysaon Hemphilli.
Succinea rusticana.
Oregonensis.
Nuttalliana.

Over the whole of this province we find also the following species common to Eastern North America. They also extend over the whole northern portion of the continent, where the mountains by their lower altitude are not barriers to distribution. It is, no doubt, from these regions that they have spread through the Pacific Province, and not westward over the Rocky Mountains. Had other Eastern species extended over the boreal regions, we should, no doubt, have found them also spreading into the Pacific States. They are especially found along the Sierra Nevada.

Zonites arboreus.
indentatus.
minusculus.
milium.
Limax campestris?
Patula striatella.
Helicodiscus lineatus.
Punctum minutissimum.

In the Pacific Province we also find several species common to the circumpolar regions of Asia, Europe, and America. They have likewise spread southward along the Sierra Nevada and on either side of it.

Thus his Californian and Rocky Mountain Sub-Region are identical with my Pacific and Central Provinces. His Canadian Sub-Region is about the same as my Northern Region of the Eastern Province. His Alleghany Sub-Region includes both my Interior and Southern Region of the Eastern Province.

[1] A most interesting account of this fauna is given by Dr. J. G. Cooper: "On the Distribution and Localities of West Coast Helicoid Land Shells" (Am. Journ. of Conch. II. p. 211, with a map).

They have also spread southward over the Central and Eastern Provinces, and now inhabit most, if not all, of North America. They are

Zonites fulvus.
Ferussacia subcylindrica.

Other species will probably be added to this list by further search; among them *Vallonia pulchella.*

In dealing with the species from the North in Eastern North America (see below, p. 27), the question of their distribution will be more fully discussed.

In addition to the species already enumerated as common to the whole Pacific Province, there are many more restricted in their range. It appears that the Pacific Province is divided into two regions, (*a*) the Oregonian and (*b*) Californian, the two intermingling slightly or overlapping in the extreme north of California, near Humboldt Bay. The faunas of these regions are nearly allied.

(*a*) The Oregon Region lies between the Cascade Mountains and the Pacific Ocean, extending northerly through British Columbia into Alaska.

The following species are peculiar to it:[1]—

Zonites Stearnsi.
Microphysa Lansingi.
Mesodon devia.
Aglaja fidelis.
Arionta Townsendiana.
Arion foliolatus?
Hemphillia glandulosa.
Succinea Hawkinsi.

There seems to be here some overlapping of the Pacific and Central Provinces, as *Arionta Townsendiana, Mesodon devia*, and *Macrocyclis Vancouverensis* extend along the mountains southeasterly into Idaho and Montana. The former two become much dwarfed in size at their most eastern range.

(*b.*) The Californian Region extends from Humboldt Bay to San Diego, between the Sierra Navada and Cascade Mountains on the east, and the Pacific Ocean on the west.

The following are the species peculiar to it:—

Macrocyclis Voyana.
Duranti.
Vitrina Pfeifferi.
Zonites Whitneyi.
conspectus.
Zonites chersinellus.
Limax Hewstoni.
Binneya notabilis.
Ariolimax Californicus.
niger.

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[1] I formerly omitted *Onchidella borealis*, Dall, from Sitka, being doubtful whether the genus should be treated as American. More recently I have had reason to include it in my work; see below.

- **Ariolimax Hemphilli.**
  - **Andersoni.**
- **Arion ? Andersoni.**
- **Gonostoma Yatesi.**
- **Triodopsis Harfordiana.**
  - **loricata.**
- **Aglaja infumata.**
  - **Hillebrandi.**
- **Arionta arrosa.**
  - **Nickliniana.**
  - **Ayresiana.**
  - **redimita.**
  - **intercisa.**
  - **exarata.**
  - **ramentosa.**
  - **Californiensis.**
  - **Diabloensis.**
- **Arionta Carpenteri.**
  - **Mormonum.**
  - **sequoicola.**
  - **Traski.**
  - **Dupetithouarsi.**
  - **ruficincta.**
  - **Gabbi.**
  - **facta.**
  - **Kelletti.**
  - **Stearnsiana.**
- **Euparypha Tryoni.**
- **Glyptostoma Newberryanum.**
- **Pupa corpulenta.**
  - **Rowelli.**
  - **Californica.**
- **Succinea Sillimani.**
  - **Stretchiana.**

Of the above, several species extend beyond the limits of the region. Thus, *Vitrina Pfeifferi*, *Zonites Whitneyi*, *Pupa corpulenta*, *Succinea Sillimani*, *Succinea Stretchiana*, and *S. rusticana* are found also on the western slope of the Sierra Nevada in the Central Province. *Aglaja infumata* and *Macrocyclis Voyana* are also found outside the bounds of the Region, in the Oregonian Region.

With the fauna of Lower California there seems no connection, though one or two species overlap at the dividing line, as *Arionta Stearnsiana*. Another species, *A. Carpenteri*, is included in the above list, having been quoted from San Diego and Tulare Valley, California. It may, however, belong rather to the Lower California fauna,* having been

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* The peninsula of Lower California forms a distinct molluscous province of itself, extending nearly to San Diego. The following species are peculiar to it : —

- **Cœlocentrum irregulare**, *Gabb.*
- **Arionta Stearnsiana**, *Newc.*
  - **Rowelli**, *Newc.* (*Lohri*, Gabb.)
- **Euparypha areolata**, *Sowb.* (*Veitchii.* Tryon).
  - **Pandoræ**, *Forbes.*
  - **levis**, *Pfr.*
- **Berendtia Taylori**, *Pfr.*
- **Bulimus spirifer**, *Gabb.*
  - **Gabbi**, *Crosse.*
- **Bulimulus pallidior**, *Sowerby.*
  - **excelsus**, *Gould.*
  - **inscendens**, *W. G. Binn.*
  - **sufflatus**, *Gould.*
  - **pilula**, *W. G. Binn.*
  - **proteus**, *Brod.*
  - **Xantusi**, *W. G. Binn.*
  - **artemisia**, *W. G. Binn.*
- **Onchidium Carpenteri**, *W. G. Binn.*

Veronicella olivacea, Stearns, a Nicaraguan species, is also found in Lower California. Of the above list one only has been found near San Diego, *A. Stearnsiana*. Another, *A. Rowelli*, has been referred to Arizona, but with doubtful accuracy. *E. Pandoræ* and *areolata* have also erroneously been referred to California. *A. Remondi* (*Carpenteri*) is omitted from the list, as it also occurs in the California Region. It is the only species described from that region under the name of *H. Remondi*, and from Guaymas. *Veronicella olivacea*, Stearns, a Nicaraguan species, is also said to extend into California. I should also mention that *Binneya notabilis* has been found on Guadalupe Island, off the coast of Lower California.

From the list of California species are omitted *Columna Californica*, actually collected at Marmato, New Granada, by Mr. Bland, and *Zonites cultellatus*, probably an accidentally introduced European shell. *Bulimus Californicus* is also omitted, belonging, no doubt, to the region of Mazatlan. Also *Glandina Albersi*, which we know to live in the Sierra Madre.

Separate lists of species peculiar to the several regions of the Pacific Province are given above. There now follows a complete list of all the species hitherto observed in the entire Province.

Macrocyclis Vancouverensis.
sportella.
Voyana.
Duranti.
Zonites Whitneyi.
arboreus.
indentatus.
minusculus.
milium.
conspectus.
chersinellus.
Stearnsi.
fulvus.

Vitrina Pfeifferi.
Limax campestris.
Hewstoni.
Prophysaon Hemphilli.
Ariolimax Columbianus.
Californicus.
niger.
Hemphilli.
Andersoni.
Arion ? foliolatus.
? Andersoni.
Binneya notabilis.
Hemphillia glandulosa.

common to the peninsula and mainland of Mexico. The most interesting fact in the fauna of Lower California is the presence of *Bulimulus proteus* and *B. pallidior*, — species described originally from South America, the former from Chili. Such facts can only be accounted for by a theory of former connection of the two points.

Though still more remotely connected with the subject of this paper, it will be interesting to add here a list of species found at and north of Mazatlan, on the Pacific coast of Mexico.

Glandina turris, *Pfr.*
Albersi, *Pfr.*
Holospira Remondi, *Gabb.*
Patula Mazatlanica, *Pfr.*
Arionta Carpenteri, *Newc.*
Polygyra anilis, *Gabb.*
Behri, *Gabb.*

Polygyra acutedentata, *W. G. Binn.*
ventrosula, *Pfr.*
Bulimulus Ziegleri, *Pfr.*
Californicus, *Rve.* ?
Orthalicus undatus, *Brug.*
Pupa chordata, *Pfr.*
Succinea cingulata, *Forbes.*

Of the above, *P. Mazatlanica* has lately been quoted from San Francisco, confounded with some allied species, as I have since learned.

A. Mormonum is omitted from this list, its presence in Sonora not having been confirmed, although asserted, doubtfully, by Messrs. Fischer and Crosse.

- Patula striatella.
- Microphysa Lansingi.
- Helicodiscus lineatus.
- Gonostoma Yatesi.
- Triodopsis Harfordiana.
  - loricata.
- Mesodon Columbiana.
  - germana.
  - devia.
- Aglaja fidelis.
  - infumata.
  - Hillebrandi.
- Arionta arrosa.
  - Townsendiana.
  - tudiculata.
  - Nickliniana.
  - Ayresiana.
  - redimita.
  - intercisa.
  - exarata.
  - ramentosa.
  - Californiensis.
  - Carpenteri.
  - Mormonum.
- Arionta sequoicola.
  - Diabloensis.
  - Traski.
  - Dupetithouarsi.
  - ruficincta.
  - facta.
  - Gabbi.
  - Kelletti.
  - Stearnsiana.
- Euparypha Tryoni.
- Glyptostoma Newberryanum.
- Ferussacia subcylindrica.
- Pupa Rowelli.
  - Californica.
  - corpulenta.
- Succinea Sillimani.
  - Stretchiana.
  - Hawkinsi.
  - rusticana.
  - Nuttalliana.
  - Oregonensis.
- Punctum minutissimum.
- Veronicella olivacea.

Several of the above will eventually prove to be synonymes, but the total number of species is small in comparison with the great size of the Pacific Province. An equal extent of territory in the Mississippi Valley, or even on the Atlantic coast, would show a larger number; and the comparatively small regions of Texas, Florida, and the Cumberland Mountains would each show an equal number of species peculiar to itself, independent of what they have in common with the rest of Eastern North America. This disparity in number is still more plainly shown in the separate region of Oregon. Thus it appears that the Pacific Province is not rich in the number of its species, but it is peculiarly favored in their size and beauty, — in this respect strikingly in contrast with the Central Province and Eastern Province.

From the Central Province the Pacific Province is quite distinct. A few species have been shown above to inhabit both slopes of the Sierra Nevada, and a few of the Oregon species have passed the barrier of the Cascade Mountains on the north,[1] but the peculiar Pacific forms, such as *Arionta* and *Aglaia*, are unknown in the Central Province. On the other hand, the only form which has any development in the Central Province, *Patula*, is scarcely known in the Pacific Province.

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[1] Since the above was published I have received living specimens of *Patula solitaria* from the Dalles on the Columbia River, proving that that species has passed the barrier of the Cascade Mountains and penetrated into the Pacific Region. It had already been noticed in the Central Province.

Compared with Eastern North America, or the Eastern Province, as it is designated below, the Pacific Province is remarkable for the absence of all the larger *Zonites.* The presence of the smaller species, also, may perhaps be accounted for by migration from the north, so that the genus *Zonites* cannot be considered as characteristic of the Province. The genus *Pupa* is less common. The genera *Tebennophorus* and *Pallifera,* so universally distributed in Eastern North America, are unknown, and so are the southern genera *Glandina* and *Bulimulus.* On the other hand, we find the genus *Macrocyclis* much more developed, and meet several genera unknown in the Eastern Province, such as *Ariolimax, Binneya, Prophysaon,* and *Hemphillia.* The genera of disintegrated *Helix* are proportionally more developed in the Pacific Region, and are represented by quite dissimilar subgenera. The genera so peculiar to the Eastern Province, *Polygyra, Stenotrema, Triodopsis, Mesodon,* are scarcely represented. In their place we find *Aglaia* and *Arionta,* forms unknown in the Eastern Province. The latter, though feebly represented in Europe, is characteristic of California. It is prolific of species and also of varieties to a degree which has caused some confusion in the synonymy. *Glyptostoma* is also peculiar to California.

From Lower California and Mexico the Pacific Region has been shown to be equally distinct, wanting entirely the *Holospira, Glandina, Bulimulus,* and *Zonites* of those regions.

Failing on the north, east, and south, the west alone is left to us from whence to trace the pulmonate fauna of the Pacific Region, and here the secret of its origin lies buried under the Pacific Ocean.[1]

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[1] A subsidence of eight hundred feet in the continent of North America would leave on its eastern shore a strip of land of about equal size of our Pacific Region, equally distinct in its terrestrial mollusca from the balance of the continent. In this case, however, we should have a distant island of the Appalachian chain on which we should find all the species of the eastern coast of the mainland. This would give us a proof of what we can now only suspect as regards the Pacific Province, — of former more wide distribution of its pulmonate fauna. From wherever the fauna may have originated, we can easily explain its present condition. The physical and climatic features of the Pacific Region are such as readily to account for its richness in terrestrial mollusks in comparison with the less favored Central Province, and even with the Eastern Province. In the supposed subsidence in the Southern Region the change would be still greater. All the species peculiar to it, catalogued on p. 35, would perish, excepting *Bulimulus dealbatus.* This species would still be found in Kentucky, restricted to a small area ; all record of its former wide distribution being at the same time destroyed.

The West Indian and South American species, catalogued on pp. 36, 37, would no longer

II. The Central Province extends from Mexico to the British Possessions, between the Rocky Mountains on the east, and the Sierra Nevada and Cascade Mountains on the west.

The following are the species peculiar to the province : —

- **Limax montanus.**
- **Patula strigosa.**
  - **Cooperi.**
  - **Haydeni.**
  - **Idahoensis.**
  - **Hemphilli.**
- **Patula Horni.**
- **Microphysa Ingersolli.**
- **Polygyrella polygyrella.**
- **Mesodon Mullani (=devia).**
- **Pupa Arizonensis.**
  - **hordeacea.**

The second and third of these species, perhaps identical, are also found on the eastern slope of the Rocky Mountains, in Wyoming and Dakota, in company with *P. solitaria.* I have shown above that the last-named species has penetrated the Central Province, and even passed the barriers of the Pacific Province at the Dalles.

To the above must be added, as inhabiting the province, but not peculiar to it, the following species from the Pacific Province, inhabiting either slope of the Sierra Nevada : *Vitrina Pfeifferi*, *Zonites Whitneyi*, *Pupa corpulenta*, *Succinea Sillimani*, and *Succinea Stretchiana.* The following, also, from the Oregonian Region of the Pacific Province, *Mesodon devia*, *Arionta Townsendiana*, and *Macrocyclis Vancouverensis*, are found at its most northern point, though the former two species are reduced in size.

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be found on the North American Continent, nor would any record be preserved of the former connection of the regions. Indeed, no one would then suspect that the tropical genera *Glandina*, *Veronicella*, and *Cylindrella* had ever been represented on the eastern portion of this continent.

The West India Islands being much more widely separated from North America, the presence among them of the small American species (catalogued on p. 37) would be still more difficult to explain.

Again, the supposed subsidence would destroy most of the species peculiar to the Sub-Region of Texas (see p. 37), and remove the evidence of the present intermingling of the North American and Mexican faunas in that Sub-Region.

Another effect would be to remove from our reach all evidence of the origin of our species in Post-pleiocene days, the fossil deposits in the bluffs being rendered inaccessible. Thus one would not be able to have correct impressions of the origin and distribution of certain species. The non-pulmonate *Helicinæ* give the best instance of this. Finding *Helicina orbiculata* and *occulta* confined to the narrow limits of the Appalachian Island, one would have no reason to suspect their past history has been so much more interesting than that of many of the species of *Stenotrema*, etc., found with them, which never had had a larger distribution. It would be impossible to know that *Helicina orbiculata* and *occulta* flourished greatly in Post-pleiocene times ; that later, one of them, *occulta*, became comparatively rare and restricted in range, while *orbiculata* became very numerous in

We find, also, over the Central Province the following species, whose derivation can readily be traced to the north;[1] *Zonites minusculus, fulvus, indentatus, Vallonia pulchella, Helicodiscus lineatus, Patula striatella, Ferussacia subcylindrica.*

Arionta Rowelli, a Lower California species, is omitted from the list, its presence in Arizona not being well authenticated.

The fauna of the Central Province is quite distinct from that of the Pacific Province, but is nearly allied to that of the Eastern Province, its genera being the same, excepting *Polygyrella.* It may therefore be of the same origin as the fauna of the Eastern Province.

The paucity of species over this large province is owing to the nature of its climate and soil, — causes in equal force on the western border of the Eastern Province.

In order to avoid mistakes in the study of the geographical distribution of North American Land Shells, one must constantly bear in mind the

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individuals over a vast extent of territory; and finally, that our supposed subsidence gradually restricted them to the Appalachian Island.

This supposition of subsidence might be carried still further, till we should have in certain islands of the Appalachian chain the sole resting-places of the now widely distributed Eastern North American fauna. The more southern of these islands would alone retain the species of the present Cumberland Sub-Region, and thus be much richer in species than the more northern islands. On the other hand, these more northern islands would possess species derived from the present northern regions which would not be found in the southern islands.

Still more instructive is the supposition of a subsidence in Eastern North America which would leave above the level of the sea only two groups of islands, formed by the White Mountains of New Hampshire, and Mount Mitchell and Black Mountain of North Carolina. On the latter we may suppose would be preserved all the species given in the lists on pp. 32, 33. Of these species all would be peculiar to the island, except such as are named in the list on p. 30, which would all be found also in the White Mountains, where we should also find the following species peculiar to the islands, *Mesodon Sayii, dentifera; Vitrina limpida; Zonites milium, Binneyanus, ferreus, exiguus, multidentatus; Patula striatella, asteriscus; Pupa decora; Vertigo Gouldi, Bollesiana, simplex; Succinea Totteniana.* Of the former distribution of these species nothing could be known, but a former connection of the two groups of islands would be surely indicated by the presence of so large a proportion of species common to each. A former connection of the two groups of islands with Europe and Asia would be as surely indicated by the presence on each of *Zonites fulvus, nitidus, viridulus; Acanthinula harpa; Vallonia pulchella; Ferussacia subcylindrica,* and *Pupa muscorum.* Nor could it escape the attention of conchologists that these and other small species, *Z. arboreus,* etc. (see p. 27, note), proved that a former connection must have existed between these groups of islands and the far-off Central and Pacific Provinces.

[1] See remarks on the distribution of these species over Eastern North America, below.

changes in the names and boundaries of the trans-Mississippi States and Territories.[1]

III. The Eastern Province comprises the remaining portions of the continent north of Mexico. The species by which it is inhabited have been derived partly from the north, partly from the interior, and partly from the south. It may therefore be divided into the (*a*) Northern Region, (*b*) the Interior Region, and (*c*) the Southern Region.

(*a*.) The Northern Region[2] comprises the whole northern portion of the continent, including Greenland and Alaska. Its southern boundary is not perfectly known, and probably not exactly marked; it may, however, be indicated in general terms as the same with the political division between the British Possessions and the United States to the northeast corner of New York, where it runs southwesterly along the Appalachian chain of mountains to Chesapeake Bay, thus including all New England, and the portions of New York, New Jersey, Pennsylvania, and Maryland lying east of those mountains. Into this southern extension of the Region we find the Interior Region overlapping, as will be shown below while treating of the Interior fauna. At other points in the Region, also, have been found species from the Interior Region,[3] especially small *Zonites*, which are able to bear the severe climate of the north.

The following are the species of the Northern Region: —

Vitrina limpida.
    Angelicæ.
    exilis.
Zonites fulvus.
    nitidus.
    viridulus.
    Fabricii.
    milium.
    Binneyanus.
    ferreus.
    exiguus.
Zonites multidentatus.
Patula striatella
    asteriscus.
    pauper.
Acanthinula harpa.
Vallonia pulchella.
Ferussacia subcylindrica.
Pupa muscorum.
    Blandi.
    Hoppii.
    decora.

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[1] Thus, *Helix Mullani* was described in Land and Freshwater Shells of North America, I. 131, from points in Washington Territory and Oregon. Both localities are now in Idaho. (1875.)

[2] For a description of this Region, see Vol. I. pp. 124, 125, under sections 5 and 6. The American land shells, especially those of the Interior Region, are forest species; they become rare towards the Northern Region of the continent as the deciduous trees become rare.

[3] See Proc. Phila. Acad. N. S., 1861, p. 330, for the northern range of species from the Interior Region.

Pupa borealis.
Vertigo Gouldi.
Bollesiana.
simplex.
Punctum minutissimum.
Succinea Haydeni.
Verrilli.
Higginsi.
Groenlandica.
Totteniana.

Of the above, several are circumpolar species, common to the three continents of Europe, Asia, and America. There being no mountain-barriers in these regions, they are not restricted in their range across America. In their progress southward, also, they have met with no transverse mountain-barriers, but have spread equally on the east and west of the Rocky Mountains and Sierra Nevada. Hence we find them common to the whole of North America.[1] Such are : —

Zonites viridulus.
fulvus.
nitidus.
Acanthinula harpa.
Vallonia pulchella.
Ferussacia subcylindrica.
Pupa muscorum.

This list will be increased should it be proved that Mr. Gwyn Jeffreys[2] is correct in referring the following American species to those of Europe : Vitrina limpida = V. pellucida, Punctum minutissimum = Helix pygmæa, Drap., Limax campestris = L. lævis, Müll., Vertigo Gouldii = V. alpestris, Ald., Vertigo Bollesiana = V. pygmæa, Drap., V. ovata = V. antivergo, Drap., V. ventricosa = V. Moulinsiana, V. simplex = V. edentula, Drap., Succinea ovalis = S. elegans, Risso, S. Totteniana = S. putris, Drap. var. A comparison of the lingual dentition of many of these has convinced me that Mr. Gwyn Jeffreys is not correct, as shown below in the descriptive portion of my work, under each species of the list.

From Asia have come into Alaska the following : *Vitrina exilis, Patula pauper, Pupa borealis.*

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[1] In the same way we can account for the distribution of the small eastern species over the Central and Pacific Provinces. They have not crossed the mountain-barriers, but spread southward from their wider range in the north. Such are : —

Zonites arboreus.
indentatus.
minusculus.
milium.
Limax campestris.
Patula striatella.
Helicodiscus lineatus.
Punctum minutissimum.

These northern species, both indigenous and circumpolar, may have been assisted in their migration southward by glacial agencies. There is a wide field for speculation here.

[2] Ann. and Mag. N. H., 1872, 245, 246.

The species peculiar to Greenland are *Vitrina Angelicæ*, *Zonites Fabricii*, *Pupa Hoppii*, and *Succinea Groenlandica.* Of these, *Pupa Hoppii* has, however, also been found on Anticosti Island.

Into this Northern Region have also been introduced by commerce from Europe the following: *Zonites cellarius*, at most of, if not at all of, the ports from New York to Halifax; *Limax flavus*, *L. agrestis*, and *Arion fuscus*, which follow the white man over the whole United States, living around his habitations; and *L. maximus*, also around human habitations, but noticed only in Newport, R. I., New York City, and Philadelphia; *Fruticicola hispida* at Halifax, *F. rufescens* at Quebec; *Tachea hortensis* on the islands off the coast of New England and the British Provinces, and on the mainland in Canada and Greenland.

Of the species referred above to the Northern Region, several have spread beyond its limits. *Vitrina limpida* has been found in Central New York; *Zonites viridulus* extends to Mexico; *Z. milium* to San Francisco and Kentucky; *Z. fulvus* and *Vallonia pulchella* all over the United States; *Zonites nitidus*, *Z. multidentatus*, and *Punctum minutissimum* to Ohio, the last to Texas and to California; *Ferussacia subcylindrica* to the States south of the Great Lakes and into California and New Mexico; *Patula striatella* to Virginia, as well as into Oregon and Nevada.

The Northern Region does not differ in the characteristics of its fauna from that lying south of it, but its climate is too severe for any but the more hardy forms. Thus, we find only the small species of *Zonites* and disintegrated *Helix*, with the genus *Vitrina*. Compared with the balance of North America, the Region is peculiar for the great distribution of its species east and west, owing to the mountain-ranges having here lost the great elevation which they have farther south, and thus ceasing to be barriers to distribution. The Region is also interesting as being the source from whence have spread southward over the whole continent several small species now found in Florida and Texas, and even in Mexico and the West Indies.

(*b*.) The Interior Region lies to the south of the Northern Region, but extends only as far as the Rocky Mountains[1] on the west. Southerly it extends to the alluvial regions of the Atlantic and Gulf coasts, the dividing line here not being sharply defined.

This is the only portion of the continent where we have evidence of the origin of our land mollusks in former geological times. In the Post-pleiocene deposits along the Ohio and Mississippi Rivers are found immense beds of shells, "proving that our existing species were living at a period which, though recent in a geological sense, was anterior to the last geological revolution, when the surface of this portion of the earth was brought to its present condition, and to the existence of the higher order of animals which now inhabit it, and even to that of the extinct mammalians which are known only by their gigantic remains."[1]

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[1] This is the extreme limit, but before reaching it the land shells have become very rare, owing to the nature of the soil. For a description see Vol. I. l. c.

From the evidence gathered from these deposits, it appears that the fauna of this Region can be traced to Indiana and Ohio. From this centre the species have extended over the Region; some of them also have passed the barrier of the Appalachian chain into the Northern Region, and some have spread, with the enlargement of the continent, into the Southern Region. Another theory might suggest that the Cumberland Sub-Region was the point of origin of all the species, those still restricted to that sub-region not being adapted to the wider distribution which the other species have obtained. Any one familiar with the habits of snails is well aware how much they differ in this respect. Some are much more disposed to migrate than others. Thus, *Triodopsis appressa* is content to remain within a radius of a few feet under a decaying log; *Mesodon thyroides* is more restless, travels much, and climbs trees; *Tachea nemoralis* has no local attachments, migrating far and wide. These facts I have verified in my own garden during many years. The *Triodopsis appressa* spoken of are descendants of Illinois specimens given me twenty years ago by the lamented Kennicott.

I will here mention that a colony of *T. appressa* has lately been found in the island of Bermuda, no doubt introduced on plants.

The following species have actually been found fossil in the Post-pleiocene deposits:—

Zonites arboreus.
fuliginosus.
inornatus.
intertextus.
ligerus.
gularis.

Macrocyclis concava.
Patula solitaria.
alternata.
perspectiva.
Helicodiscus lineatus.
Strobila labyrinthica.

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[1] See Vol. I. 185. It must be remembered that the glacial epoch would not destroy this fauna, as the ice sheet did not extend over the southern portion of the Region. Here the species would be preserved, and from hence, after the disappearance of the ice, they would repeople the whole Region.

Polygyra auriformis.
Stenotrema stenotremum.
hirsutum.
monodon.
Triodopsis palliata.
obstricta.
appressa.
inflecta.
Mesodon albolabris.
elevata.
Mesodon exoleta.
thyroides.
clausa.
profunda.
Pupa armifera.
contracta.
Succinea obliqua.
Helicina[1] **orbiculata.**
occulta.

Of the above all are now living and are equally numerous, excepting *Helicina occulta*, a species most abundant in Post-pleiocene days, but now almost extinct.[2] The other species of *Helicina* is now confined to more southern limits.

In addition to the above, the following species, now living in the Interior Province, probably had their origin in Post-pleiocene times and will, no doubt, be found fossil in the "bluffs":—

Zonites friabilis.
lævigatus.
suppressus.
indentatus.
internus.
minusculus.
limatulus.
Polygyra Dorfeuilliana.
leporina.
Mesodon multilineata.
Pennsylvanica.
Mitchelliana.
dentifera.
Mesodon bucculenta.
Sayii.
Triodopsis tridentata.
fallax.
Pupa pentodon.
fallax.
rupicola.
corticaria.
Vertigo milium.
ovata.
Succinea avara
ovalis.

Tebennophorus Caroliniensis, Pallifera dorsalis, and *Limax campestris* probably have also come down from Post-pleiocene times. From their nature they could leave no record of their presence in the "bluffs."

There are also found in the Interior Region several forms of *Succinea* of doubtful specific value, which have been described as

Succinea retusa.
Grosvenori.
lineata.
Succinea aurea.
Mooresiana.

The following is a complete list of those species of the Interior Region which have spread beyond it by passing the barriers of the Appalachian chain, and are now found over New England and the whole southern extension of the Northern Region, described on p. 26, as well as over the whole Southern Region. They may therefore be said to inhabit all of the Eastern Province.

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[1] Though not *Pulmonata*, these two species are strictly terrestrial in their habits, and are here introduced from their value on the question of the permanence of the Post-pleiocene species. One of them is almost extinct, the other more restricted in its range at present.

[2] See Vol. I. 183, 184; Bland and Binney, Ann. Lyc. N. H. of N. Y., IX. 289.

- **Macrocyclis concava.**
- **Zonites fuliginosus.**
  - **inornatus.**
  - **suppressus.**
  - **indentatus.**
  - **arboreus.**
  - **minusculus.**
- **Limax campestris.**
- **Patula alternata.**
- **Helicodiscus lineatus.**
- **Strobila labyrinthica.**
- **Stenotrema hirsutum.**
  - **monodon.**
- **Triodopsis palliata.**
  - **tridentata.**
- **Triodopsis fallax.**
- **Mesodon albolabris.**
  - **thyroides**
- **Pupa pentodon.**
  - **fallax.**
  - **armifera.**
  - **contracta.**
  - **rupicola.**
  - **corticaria.**
- **Vertigo milium.**
  - **ovata.**
- **Succinea avara.**
  - **obliqua.**
- **Tebennophorus Caroliniensis.**
- **Pallifera dorsalis.**

Mesodon Sayii and *M. dentifera* have spread into New England only from the Interior Region. They have not been found in more southern latitudes on the Atlantic slopes of the Appalachian chain, nor in the Southern Region.

The geographical range of these species is very great, forming one of the most striking features of the North American fauna. Still more widely distributed are those minute species which have been mentioned above as spreading southwardly from the Northern Region equally on both sides of the Sierra Nevada and Rocky Mountains. These species may be said to inhabit the whole continent of North America as far south as Mexico. The range of some is still greater. Thus, *Zonites minusculus* has been found from British Columbia to Labrador on the north, to Yucatan and Florida on the south, and still farther in Cuba, Jamaica, Porto Rico, and Bermuda. *Strobila labyrinthica* also is found over all Eastern North America, and perhaps in Mexico (as *H. Strebeli*, see Fischer and Crosse, Moll. Mex. et Guat., 267). It is also by some considered identical with an Eocene fossil of France and England. (See below.) *Zonites arboreus* ranges from Labrador to New Mexico, and in Nevada and California, and from British Columbia to Florida, Cuba, and Guadaloupe. *Vertigo ovata* is found from Maine to Mexico and in Cuba.

The character of the soil and climate, with, perhaps, the gradual elevation, is such as to render the land shells rare, if not quite extinct, before the Rocky Mountains are reached, the western boundary of the Interior Region. But one species, *Patula solitaria*, seems to have passed this mountain-barrier into the Central Province. This is found with *P. Cooperi* in Montana and Idaho, very difficult to distinguish from forms of the last species. It is, however, oviparous (from Salmon River, Idaho), while *P. strigosa*, *Cooperi*, *Hemphilli*, and *Idahoensis* are viviparous.[1] It has also passed into the Pacific Province at the Dalles.

The following list contains the names of all the species inhabiting the Interior Region, including those which have spread into it from the Northern Region: —

Macrocyclis concava.
Zonites fuliginosus.
  friabilis.
  lævigatus.
  ligerus.
  intertextus.
  inornatus.
  nitidus.
  arboreus.
  viridulus.
  indentatus.
  limatulus.
  minusculus.
  fulvus.
  gularis.
  suppressus.
  internus.
Limax campestris.
Patula solitaria.
  alternata.
  perspectiva.
  striatella.
Helicodiscus lineatus.
Strobila labyrinthica.
Polygyra Dorfeuilliana.
  leporina.
  auriformis.
Stenotrema stenotremum.
  hirsutum.
  monodon.
Triodopsis palliata.
  obstricta.
  appressa.
  inflecta.
  tridentata.
Triodopsis fallax.
Mesodon albolabris.
  multilineata.
  Pennsylvanica.
  Mitchelliana
  elevata.
  exoleta.
  dentifera.
  thyroides.
  clausa.
  profunda.
  Sayii.
Acanthinula harpa.
Vallonia pulchella.
Pupa muscorum.
  pentodon.
  fallax.
  armifera.
  contracta.
  rupicola.
  corticaria.
Vertigo milium.
  ovata.
Succinea retusa.
  Grosvenori.
  Mooresiana.
  ovalis.
  lineata.
  avara.
  aurea.
  obliqua.
  Totteniana.
Tebennophorus Caroliniensis.
Pallifera dorsalis.

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[1] It has been suggested by Dr. H. Dohrn that this characteristic is connected with the fact of the great dryness of the soil in the Central Province. The young shell is ready to

The above list shows the Interior Region to be remarkable for the development of the section of *Zonites* familiar by the European *Z. olivetorum* (*Mesomphix* of Alb. ed. 2). Of the disintegrated genus *Helix* the section or genus *Mesodon* is most developed. This is almost exclusively a North American subgenus, as is also *Triodopsis*, which is also greatly developed in the Interior Region.

In addition to the species included in the above list as inhabiting all of the Interior Region, there is a large group of species found within its limits, but having a more restricted range. They are found in what may be called the Cumberland Sub-Region. This is comprised in the southern portion of the Appalachian chain, situated in Eastern Tennessee and the adjoining counties of North Carolina, with an offshoot into the mountains of West Virginia.[1]

The following species are peculiar to this Sub-Region: —

Vitrina latissima.
Zonites capnodes.
  subplanus.
  sculptilis.
  Elliotti.
  demissus.
  capsella.
  placentula.
  lasmodon.
Patula Cumberlandiana.
  tenuistriata?
Polygyra fastigans.
  Troostiana.
  Hazardi.
Stenotrema spinosum.
Stenotrema labrosum.
  Edgarianum.
  Edvardsi.
  barbigerum.
  maxillatum.
Triodopsis Rugeli.
  introferens.
Mesodon Clarki.
  Christyi.
  Lawi.
  Wheatleyi.
  Wetherbyi.
  Downieana.
Pallifera Wetherbyi.

Of these, several have spread beyond the limits given above for the Sub-Region. Thus, *Zonites lasmodon* and *Stenotrema spinosum* have been found in Northern Alabama. *Polygyra Hazardi* has also spread into Northern Alabama, and equally into Georgia and Kentucky. *Stenotrema labrosum* and *Edgarianum* in Alabama, and in one case have been collected in Arkansas. *S. barbigerum*, *S. maxillatum*, and *Zonites capnodes* have found their way into Alabama and Georgia; *Mesodon Clarki* into Georgia. *Zonites subplanus* has been found even in Pennsylvania,

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protect itself from the moment of its birth, while, if deposited as an egg by the parent, it might perish from drought.

[1] For a description of its physical and climatic characters, see Vol. I. 122. It is there designated as the Southern Interior Section, and is given a wider western range.

having, no doubt, crept along the mountain chain; but no other of the species of the Cumberland Sub-Region has been found as far north, excepting *Z. demissus.* This last-named species is found in a highly developed state in Eastern Tennessee, and has extended into Western Pennsylvania, North Carolina, Georgia, Alabama (near Mobile), and Arkansas in a much dwarfed condition.

If to the twenty-nine species catalogued above as peculiar to the Sub-Region are added the sixty-six species which inhabit it as a portion of the Interior Region (see p. 32), it will be seen that in the Cumberland Sub-Region we find the largest number of species of any portion of North America. The Sub-Region is equally prolific in individuals, and the individuals are highly developed. These facts are partially explained by the nature of the country. Low mountains, thickly shaded, well-watered, and with a genial climate and proper soil, offer in their thickets and ravines innumerable safe breeding-grounds for the land shells.[1] There seem also to be in this Sub-Region conditions peculiarly conducive to testaceous variation. Six (or twenty per cent) of its peculiar species are carinated, and here also the following species of the Interior Region show the same tendency to carination, — *Zonites ligerus*, *intertextus*, *Patula alternata*, *Triodopsis appressa* and *palliata*. Here, also, we first notice the variation of *Patula alternata* towards heavy ribs upon its shell; which is still more apparent as the species extends towards the southwest.[2] Here, also, *Mesodon elevata* is often found banded.

The Cumberland Sub-Region is peculiar for the development of *Zonites*, and in the disintegrated genus *Helix* for the development of the section or genus *Stenotrema*, almost peculiar to these narrow limits.

(*c.*) The Southern Region comprises the peninsula of Florida, with the adjacent islands, together with the alluvial regions of the Atlantic and Gulf coasts. It includes, therefore, the eastern portion of North Carolina, South Carolina, Georgia, all of Florida, the southern part of Alabama, Mississippi, Louisiana, extending into Texas.[3] Its boundaries, however, are but imperfectly known, and probably not accurately defined. Many of the species from the Interior Region and Cumberland

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[1] See Vol. I. pp. 122, 123. Being less adapted for cultivation than the balance of Eastern North America, we may hope for the preservation of our land shells in this Region, while they decrease rapidly before the advance of civilization elsewhere. See *Ibid.*, pp. 132, 133.

[2] This heavily ribbed form was common in Post-pleiocene days.

[3] See Vol. I. 120, for a description of the Region.

Sub-Region have spread into its northern portion, and the following have extended over the larger portion of it : —

- **Macrocyclis concava.**
- **Zonites fuliginosus.**
  - **inornatus.**
  - **suppressus.**
  - **indentatus.**
  - **arboreus.**
  - **minusculus.**
- **Limax campestris.**
- **Patula alternata.**
- **Helicodiscus lineatus.**
- **Strobila labyrinthica.**
- **Stenotrema hirsutum.**
  - **monodon.**
- **Triodopsis palliata.**
  - **tridentata.**
  - **fallax.**
- **Triodopsis Van Nostrandi.**
- **Mesodon albolabris.**
  - **thyroides.**
- **Pupa pentodon.**
  - **fallax.**
  - **armifera.**
  - **contracta.**
  - **rupicola.**
  - **corticaria.**
- **Vertigo milium.**
  - **ovata.**
- **Succinea avara.**
  - **obilqua.**
- **Tebennophorus Caroliniensis.**
- **Pallifera dorsalis.**

Equally wide over the Region has been the distribution of those minute species whose origin has been traced to circumpolar regions (see p. 26). Such are : *Zonites viridulus, fulvus,* and *Vallonia pulchella.*

In addition to these species derived from the north, are found the following species peculiar to the Region, whose origin can be traced to the south, in the peninsula of Florida, from whence, indeed, many of them have not yet spread over the whole Region : —

- **Glandina truncata.**
- **Zonites cerinoideus.**
- **Polygyra auriculata.**
  - **uvulifera.**
  - **Postelliana.**
  - **espiloca.**
  - **avara.**
  - **cereolus.**
  - **septemvolva.**
  - **Carpenteriana.**
  - **Febigeri.**
  - **pustula.**
  - **pustuloides.**
- **Triodopsis Hopetonensis.**
- **Mesodon major.**
  - **jejuna.**
  - **Mobiliana.**
- **Bulimulus Floridanus.**
  - **Dormani.**
  - **dealbatus.**
- **Cylindrella jejuna.**
- **Pupa variolosa.**
  - **modica.**
- **Succinea effusa.**
  - **campestris.**
  - **Wilsoni.**
- **Veronicella Floridana.**

Of the more widely spread species, *Polygyra septemvolva* is represented by various forms over the whole southern littoral region, both of the Atlantic and Gulf. So is *Glandina truncata, Mesodon jejuna, Polygyra* *pustula*, *pustuloides*, and *Pupa modica*. *Triodopsis Hopetonensis* extends only along the Atlantic alluvial Region. *Bulimulus dealbatus* is also distributed over the whole Region, from North Carolina to Texas, and has spread northward to Arkansas and Kentucky. *Succinea campestris* extends along the Atlantic coast as far as South Carolina, as does also *Zonites cerinoideus*, even into North Carolina and Virginia. *Polygyra espiloca* and *Postelliana* have been noticed thus far in the southeastern corner of Georgia. The former also at New Orleans and Indianola. *Succinea Wilsoni*, at Darien, Ga. *Mesodon major* extends from the Gulf to Abbeville, S. C., confined to a narrow track of territory.

The following European species have been introduced by commerce into this Region, and still exist at the points named : *Stenogyra decollata*, Lin., *Turricula terrestris* and *Pomatia aspersa*, Müll., at Charleston, S. C. ; *Cœcilianella acicula*, Müll., Florida.

From the list of species peculiar to the Southern Region it will be seen that the prevailing form is *Polygyra*, a group or genus peculiarly American, represented in the Interior Region indeed, but meeting its greatest development here. The presence of *Glandina* and *Veronicella* shows, also, the more southern character of land-shell fauna. But the Region, and especially that portion of it from whence the fauna was distributed, i. e. the southern extremity of Florida, is still more peculiar in showing the connection between the land shells of the continent of North America and those of the West India Islands and the Spanish Main. Of the species given above (p. 35), *Cylindrella jejuna* was, perhaps, introduced from Cuba, and *Bulimulus Dormani* may prove identical with *B. maculatus*, Lea, of Carthagena. The following species have evidently been introduced[1] from the West India fauna :[2]—

Zonites Gundlachi, Cuba, etc.
Patula vortex, Cuba, etc.
Hemitrochus varians, New Providence.
Cylindrella Poeyana, Cuba.
Macroceramus Kieneri, Cuba.
    Gossei, Cuba.

Bulimulus Marielinus, Cuba.
Strophia incana, Cuba.
Stenogyra subula, Cuba, etc.
    gracillima, Cuba, etc.
Liguus fasciatus, Cuba.
Orthalicus undatus, Cuba.

From Yucatan one species has been introduced, *Polygyra oppilata*.

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[1] Either by oceanic currents since the formation of the peninsula of Florida, or else from some island of the West India group, now enclosed in the peninsula. It is interesting in this connection to refer to the discovery, by Mr. Conrad, of a Tertiary fossil at Tampa Bay, *Bulimus Floridanus*, Conr. See also below, p. 40.

[2] Also several non-pulmonate species, as *Helicina subglobulosa*, Cuba ; *Ctenopoma rugulosum*, Cuba ; *Chondropoma dentatum*, Cuba.

Bulimulus multilineatus was introduced from the continent of South America,[1] where it has been found at St. Martha, N. Granada, and at Maracaibo and Pto. Cabello in Venezuela.

Florida has not only received several of its species from the West Indies, but also from its southern extremity it has contributed in return to the fauna of those islands. From hence, no doubt, *Zonites arboreus* has passed into Cuba and Guadaloupe; *Zonites minusculus* to Cuba, Jamaica, Porto Rico (Bermuda?); *Pupa fallax* to Cuba; *Vertigo ovata* to Cuba; *Zonites indentatus* to San Domingo?

From the various sources indicated above, the southern extremity of Florida has become inhabited by about seventy species of land shells, a number small in comparison with those found in the Cumberland Sub-Region (see p. 33), but large when compared with those found in the great Interior Region.

In addition to those species apparently originating in the peninsula of Florida and thence spreading over the whole Southern Region, there is found within its limits a number of species confined to the southwestern portion of the latter. These seem restricted to the southern part of Texas, which may be considered an offshoot of the Mexican fauna as shown by the presence of the genera characteristic of that country, such as *Holospira*, *Bulimulus*, and *Glandina*. Within the region, however, are many species peculiar to it, but belonging to the genera characteristic of North America, such as *Polygyra* and *Mesodon*. It seems, therefore, best to consider Texas as belonging equally to the fauna of North America and of Mexico, being the point where the two overlap. As the limits of the region are ill defined, several species extralimital to the State of Texas are included in the following catalogue of the Texan Region: —

- **Glandina Vanuxemensis.**
  - **decussata.**
  - **bullata.**
  - **Texasiana.**
- **Zonites significans.**
  - **caducus.**
- **Microphysa incrustata.**
- **Strobila Hubbardi.**
- **Polygyra ventrosula.**
  - **Hindsi.**
  - **Texasiana.**
- **Polygyra triodontoides.**
  - **Mooreana.**
  - **tholus.**
  - **hippocrepis.**
  - **Jacksoni.**
  - **Ariadne.**
  - **vultuosa.**
- **Mesodon divesta.**
  - **Roemeri.**
- **Dorcasia Berlandieriana.**
  - **griseola.**

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[1] Or from some extinct fauna which also accounts for its presence at both points.

Bulimulus patriarcha.
alternatus.
Schiedeanus.
Macroceramus Gossei.
Holospira Goldfussi.
Roemeri.
Stenogyra octonoides.
Pupa pellucida.
Succinea Haleana.
concordialis.
luteola.
Salleana.

Of the above *Polygyra Jacksoni* and *Zonites significans* are included with great hesitation. They are found at Fort Gibson, in Indian Territory.[1] They are more related to the fauna of the Cumberland Sub-Region than that of Texas.

Besides the species characteristic of the North American fauna which Texas has as a portion of the Southern Region of the great Eastern Province, we find in the above list two species peculiar to it of the characteristic American subgenus *Mesodon*, — *Roemeri* and *divesta*.[2]

Several species on the list have been introduced from other regions,[3] such as *Strobila Hubbardi*,[4] a Jamaica species, as well as *Macroceramus Gossei*, a Cuban species, which is also found on the Florida Keys. *Microphysa incrustata* from Cuba, as well as *Pupa pellucida* and *Stenogyra octonoides*.

Of the remaining species on the list, sixteen have actually been found in Mexico; probably all will be, as there seems no well-defined boundary here between the North American and Mexican fauna.

Bulimulus serperastrus, Say, although actually found in Texas, is evidently a member of the Mexican fauna, and is therefore omitted from my list, though included in the descriptive portion of my work.

The characteristic of Texas appears to be the great preponderance of the genus *Polygyra*, of the type of *P. Texasiana*, while the type of Florida, the *septemvolva*, is almost wanting. The great abundance of individuals is also remarkable, showing the Region to be peculiarly adapted

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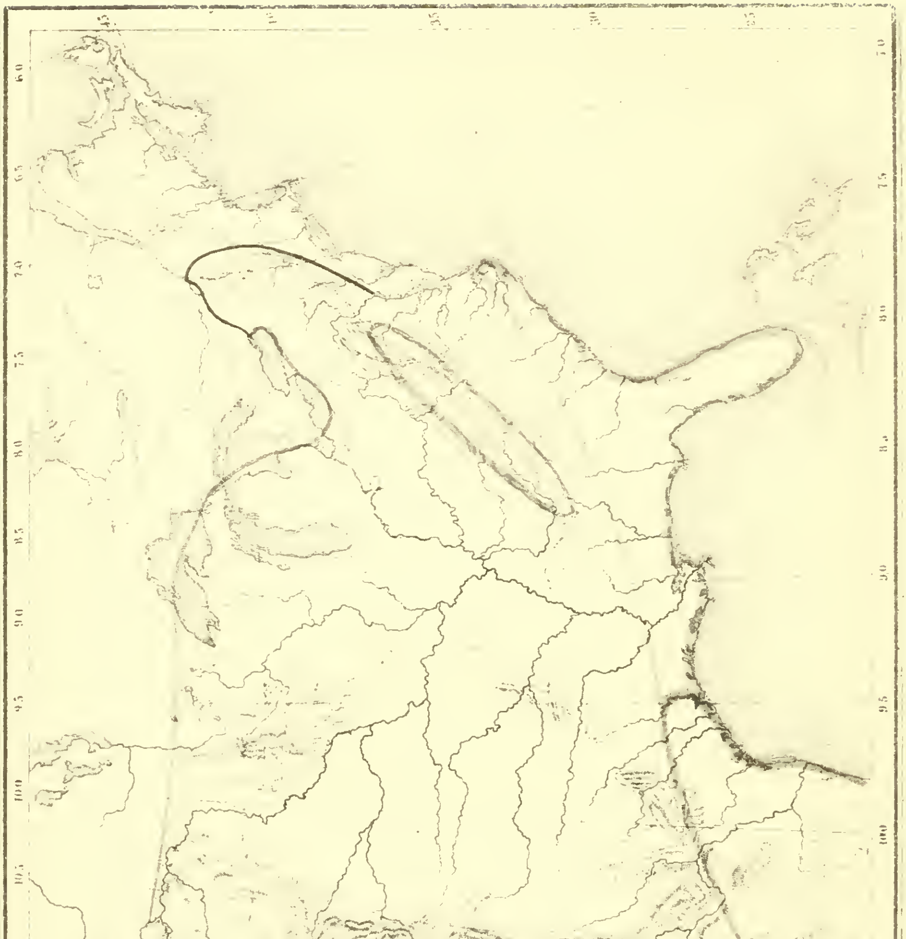
[1] See Vol. I. 122, which gives the limits of the corresponding "Southern Interior Section" such as would include these species. Several of the species of East Tennessee, also, have been found in Arkansas, — a fact also favoring a wider limit to the Cumberland Sub-Region.

[2] This species has not actually been found within the limits of the State of Texas, but in the neighboring State of Arkansas and in Mississippi. To it may be applied the remarks on *Zonites significans* and *Polygyra Jacksoni* above.

[3] Either by commerce, by oceanic currents, or from some former molluscous fauna of which these now isolated localities were offshoots.

[4] Since the above was written, this species has been found by Dr. Newcomb near Savannah, Georgia. It may therefore prove a widely distributed American species. In Jamaica it is known as *H. Vendreysiana*, Gloyne.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to pulmonate life. In the number of its species, also, the Texas Region is favored; by adding to the above list of peculiar species those which it has in common with all of the Eastern Province, and also those of the Southern Region, we find a total of seventy species, the same number as found in Florida.

On the accompanying map the Pacific Province is colored pink, the Central Province blue; the Eastern Province (of which the northern portions are not shown) is uncolored. The subdivisions, or Regions, of the Eastern Province are also indicated by colored lines. The red line marks the division between the Northern and Interior Regions. From this line the last-named region extends (its Sub-Region of the Cumberland shown by green lines) to the brown and yellow lines, which, taken together, mark the northern boundary of the Southern Region, the yellow separately indicating the Texan Sub-Region, the brown the Floridan Sub-Region.

In the above pages I have simply stated the facts now known regarding the actual distribution of our land shells, scarcely attempting to explain it. I will here venture to make a few suggestions on this subject.

The student of geographical distribution must now take as his guide the recently published work by Wallace on this subject.[1] From this he will learn that terrestrial mollusca of most of the recent genera have existed on the globe from very early geological times. Also, that, wherever originally appearing, their universal distribution over all the continents is easily explained. Thus we readily account for their presence in North America,[2] and however imperfect may be the geological record, it shows us that at least Zonites, Pupa, Helix, Bulimulus, Vitrina, Macrocyclis, and Clausilia existed here in previous geological ages. From these ancestors, no doubt, have been derived, through many intermediate stages of development, the present fauna. I have already shown that the characteristic American genera of the Eastern Province, the Mesodon, Triodopsis, Stenotrema, etc., were already established in post-pleiocene days. It is impossible to learn how much earlier they appeared, but of one significant fact we are certain, —they are more recent than the elevation of the Rocky Mountains and Sierra Nevada, for otherwise these chains would not form, as now, dividing lines between the eastern, central, and pacific fauna. There are, indeed, several small species which have passed these barriers, being found over all of North America. These same species are found equally distributed in Asia and Europe. They are undoubtedly of much earlier origin than the strictly American species, and belong to some extinct fauna of world-wide distribution. The circumpolar connection of the three continents has facilitated their distribution. In this connection it is worthy of note that one of our existing species, now confined to America (*Strobila labyrinthica*), is said to have existed in France in Tertiary days.

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[1] The Geographical Distribution of Animals, with a Study of the Relations of Living and Extinct Faunas as elucidating the past Changes of the Earth's Surface. By Alfred Russell Wallace. Amer. ed. Harper and Brothers. New York. 1876.

[2] In the following pages it will be seen that three well-established genera only — Hemphillia, Prophysaon, and Ariolimax — are peculiar to our limits, excepting perhaps a few disintegrated *Helix*.

Our Southern Region has evidently been peopled from other fauna than that which supplied the Mesodon, Triodopsis, Stenotrema, etc., of the Interior Region. It was, no doubt, from some now extinct semi-tropical fauna that these came, but long enough ago to allow the Polygyras, Glandinas, etc. to be modified into species distinct from those which from the same common origin have become the equally well-established West Indian, Central American, and Mexican species.

The Central Province has, from geological causes, been more recently peopled by pulmonata than the Eastern Province. Its local species are less numerous. *Patula* is its characteristic genus, with species so varying and intermingling one with the other that the student cannot refrain from noticing that they have the appearance of a species in a slightly advanced stage of evolution, each form not as yet established as distinct, easily recognized species.

The Pacific Province, also, presents in its variable, scarcely distinguishable *Ariontas*, a fauna of comparatively recent growth, but whence its origin it is difficult to say.[1]

Finally, we have in the list of American land shells several species, purely local in their distribution. imported through the more or less direct agency of man. Of these, *Pomatia aspersa* was no doubt introduced as an article of food by foreign residents of Charleston, S. C., and seems to have established a hold there.[2] *Zonites cellarius* was introduced by foreign shipping, probably around water-casks. It is also well known to have been introduced into other countries. The *Limaces* are found around human habitations; they seem to follow the English to all their colonies. The other foreign species mentioned on p. 36 have probably been introduced around the roots of plants, as have been other species which are from time to time sent me from greenhouses, gardens, etc. They are only local, except *Tachea hortensis*, which may have been accidentally introduced in some other manner, since the discovery of America by Europeans, and owes its present distribution in the Northeast to its being peculiarly adapted to colonization. I have elsewhere related my successful attempt to colonize the allied *Tachea nemoralis*.[1]

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[1] See Dr. Cooper, as referred to on p. 18.

[2] I have been asked what authority I have for this opinion, so think it worthy of statement that Charleston specimens belonging to the cabinet of the late General Totten still

III. THE JAW AND LINGUAL MEMBRANE.

In Volume II. my father paid great attention to the jaws and lingual membranes, figuring those of all the species which he could obtain. In continuing my father's labors on the same subject, I had described and figured those of many other species. Thus, in a certain sense, it could be said that a great deal was known of these organs in our land shells. Unfortunately, however, these figures and descriptions had become of comparatively little value when the study of this subject had assumed such importance as of late. They did not give in sufficient detail the character of the individual teeth, however correct an idea they may have given of the general arrangement of the teeth upon the membrane. I was, therefore, induced to review the whole subject, and present it in a manner which would be of value as throwing light upon classification, in the Proc. Ac. Nat. Sc. Phila., 1875, pp. 140 – 243.

In their proper places under each genus and species will be found below the result of my re-examination of the subject. I will here repeat in full some general remarks on the organs treated of, and on their

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retain a strong odor of the garlic which seasoned them for the foreign palate. I have myself had specimens given me by French residents of the town where I reside, who had bought them as food in Philadelphia. The species has also been imported into Havana, Rio Janeiro, St. Iago, Chili, and other ports as an article of food. I found numerous living specimens in St. Michael's churchyard in Charleston, S. C., in 1875, and in 1871 Professor Featherman sent me specimens from Baton Rouge.

[1] See below, under *T. hortensis*, in the descriptive portion of the work.

value for the purpose of classification, and on the bibliography of the subject. In rewriting this article for the present volume, I have considered it best to redraw all the figures for the sake of greater accuracy, as well as artistic merit.

General Remarks.

As many of my readers are quite unfamiliar with the subject, especially most of those who have so largely contributed specimens for examination, I will describe in detail the position of the organs and the method adopted for their study.

On holding up against the light an individual of *Mesodon thyroides* in one hand, and offering to him with the other some food (a piece of lettuce or carrot is always acceptable), one can readily see with the naked eye the two organs here treated of. Above the external opening of the mouth, through the tranparent tissue of the head, is seen a small, arched, reddish, free instrument, which appears to rise and fall as if used in cutting off morsels of food. This is the *jaw*.

On the floor of the mouth is the *lingual membrane*, occupying about the position of the human tongue. Its color is too nearly the same as that of the head to afford any strong contrast, but, with close attention, it will be detected by its glistening silvery appearance, as it works backward and forward. Its use seems to be to rasp the food and also to force it back into the œsophagus.

More detailed description, fully illustrated by figures, of the position of these two organs, will be found in the chapters on Special Anatomy in Volume I. (See also below, Chapter IV.)

Method of Extraction.

On opening the head of *Mesodon thyroides* from above, one readily notices at the extreme anterior part, close against the outer integument, a prominent oval body.[1] This is called the buccal mass. It is easily cut away from the animal, and will be found to contain both jaw and lingual membrane. These can be removed by fine scissors or knives from the buccal mass in the larger species, but in the smaller species the method usually employed is putting the whole buccal mass in a watch crystal full of a strong solution of caustic potash. Allowing it to remain for several hours, the potash will destroy all of the buccal mass, and leave the jaw and lingual membrane perfectly clean and ready for examination. They remain attached, if the solution is not too strong, showing a connection between the two. They must be well rinsed in clean water, in another watch crystal, before examination. Another more expeditious process is to place the whole buccal mass in a test-tube, with the solution of potash, and boil it for a few seconds over a spirit lamp. Pouring the contents of the test-tube into a watch crystal, the lingual membrane attached to the jaw will be readily seen by a pocket lens. If the species be very small, as *Patula striatella* for instance, its whole body may be thrown into the solution. Still more minute species, as *Zonites milium* for instance, may be treated in this way: crush the whole shell between two glass slides, wash away the particles of the broken shell in a few drops of water, still keeping the body of the animal on the slide; when clean, drop on it the caustic potash and boil it by holding the slide itself over the spirit lamp.

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[1] I must earnestly beg my readers to be deterred from this examination by no imaginary difficulties. It is the simplest and easiest process. Indeed, the same may be said of examination of the complete anatomy. All that is required is to carry it on under water. The various organs are then readily separated.

ON MOUNTING.

For the purpose of examination, the jaw and lingual membrane may be simply mounted in water and covered with thin glass. One must be sure to spread out the lingual membrane, not have its upper side down, and it will be well to cut it transversely in several places, as the teeth are beautifully shown, and often stand detached, on the edges of the cut.

For preservation for future study I hesitate to recommend any process, as I know of none which has been tried for a sufficiently long time. I have myself lost many specimens by imperfect mounting. Canada balsam, formerly used, ruins the membrane by rendering it too transparent. The glycerine mounting fluids, now in use, certainly preserve a membrane for several years, but they have not been tried many years, and have the great disadvantage of deliquescing in warm weather.

ON THE JAW.

The jaw and lingual membrane, having been mounted, must now be examined under the microscope.

The jaw will be found to vary greatly in its characters in the different genera. It is either in one single piece; in one single piece with an accessory quadrate piece attached to its upper margin; or in separate, detached pieces, free on their lower edges, usually soldered together into one single piece above. It differs also in being with or without a median beak-like projection to its cutting edge; also in its ends being more or less acuminated; but still more by the presence or absence of striæ or rib-like processes on its anterior surface. When present, the ribs are found in every degree of development, passing quite across the jaw and denticulating one or both margins, or only developed on the lower portion of the jaw, and crenellating the lower margin. The ribs are often almost obsolete, or represented by wrinkles or coarse striæ. They are present on the anterior surface of the jaw only, or on both anterior and posterior surfaces. They are distant, narrow, stout, few; or crowded, broad, stout, and numerous. Their number is within certain limits inconstant in the same species. They sometimes are very broad, and seem like separate plates soldered to the anterior surface of the jaw, or to be formed by a folding of the jaw upon itself. When this appearance of folding into plates is given, it will generally be found that the plait-like sections are actually separated by distinct, but delicate ribs. When this form of ribs is found, they are either vertical or inclined obliquely towards the median line of the jaw. Sometimes this last arrangement is developed to such a degree that the delicate ribs meet before reaching the bottom of the jaw, and a triangular compartment is left at the upper centre of the jaw, its base being upward. This form of jaw is usually thin and membranous.

When the jaw is striated and not ribbed, the striæ are vertical, or they converge towards the median line. There are often transverse striæ also, and transverse lines of reinforcement.

The upper margin of the jaw is often extended into a stout membranous attachment, apparently of the same material and consistency as the jaw itself, and showing the same continuity of structure by the striæ of the jaw extending into it without interruption. This is not the accessory quadrate plate mentioned above.

The jaw is found in every degree of consistency, from very thick to quite membranous and almost transparent.

The cutting margin of the jaw is smooth, crenellated, or denticulated. It is simply concave, or furnished with a more or less developed beak-like median projection.

In shape the jaw ranges from scarcely arcuate, long, low, to horseshoe-shaped, short, high.

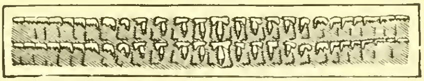
It will be seen below that these peculiarities of the jaw, taken in connection with the characters of the lingual membrane, have till now appeared to furnish reliable characters for classification. It must be confessed, however, that exceptions to the usual constancy of characters have been noticed in some genera; sometimes the difference between striæ and ribs is difficult to determine; sometimes the beak-like prominence is greatly modified by a simple median projection. In some genera, for instance *Dentellaria*, the character of the jaw is not generic.

The Lingual Membrane.

In placing the lingual membrane under the microscope, we at once perceive that it is (at least in most of our genera) a long,[1] narrow, ribbon-like organ, whose whole surface is covered with numerous small tooth-like processes, whose reflected apices are pointed, the points directed towards the œsophagus, to which, as stated above, they serve to move the food, as well as to perform a rasp-like mastication. These teeth are arranged in two series of rows, one running longitudinally, the other transversely.

On careful examination it will be seen that all the teeth of each successive longitudinal row are of the same form,[2] but that there are several types of teeth in the different parts of each transverse row. Three of these types are found, the *central* tooth, the teeth on either side of the central, called *laterals*, and the teeth extending from the laterals to the outer margins of the membrane, called *marginals*. The change from the single central to the laterals is usually abrupt, but from the laterals to the marginals it is usually gradual, so that there are several teeth intermediate between the two, which may be called *transition* teeth. The transverse rows of teeth are similar on each side of the central tooth, so that it is necessary to figure only one half of one transverse row, with its central tooth, to give an idea of the whole transverse

Fig. 2.



Two transverse rows of teeth of *Strobila labyrinthica*.

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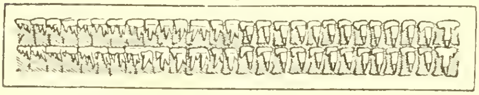
[1] It is very broad in *Orthalicus, Liguus* (see Pl. XVI.), some subgenera of *Achatinella*, some *Bulimuli*, etc.; in some subgenera of *Cylindrella* it is very narrow. On this same plate I have given figures of the membranes of the various genera, with a line showing the direction of one transverse line of teeth.

[2] Even in case of malformation this holds true. I have often found a misshapen, or otherwise abnormal tooth, repeated down the whole length of the membrane, or even that a tooth may be entirely wanting in its whole length.

row, or, indeed, of the whole membrane, as all the longitudinal rows, as stated above, have similar teeth. (See Fig. 3.)

These transverse rows differ in the various genera as to their direction, either straight, oblique, or curving, or a combination of these directions.

Fig. 3.

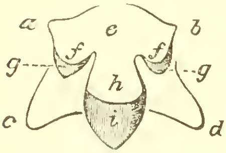


One half of two transverse rows of teeth of *Sten. hirsutum.*

Of the three types of teeth, central, lateral, and marginal, one or more may be wanting. Their number, however, is approximately constant in different individuals of the same species, so that, as a specific character, the count of the teeth on one transverse row is usually given; thus in *Zonites inornatus* I find about 23 — 1 — 23 teeth, that is, 23 teeth on each side of the central tooth, making 47 teeth in the entire transverse row.

The characters of the individual teeth vary greatly in the various genera, especially in some of the genera foreign to our limits. In most cases, however, there are two distinct types of teeth, the *quadrate* and *aculeate.* The former is shown in my figure (Fig. 4). *a, b, c, d,* is the portion of the tooth which rests upon the membrane; I have called it the *base of attachment.* It varies in its proportional length, and in the greater or less expansion of the lower[1] lateral angles. The upper margin of this base of attachment is broadly reflected; *e* marks the reflected portion, which I term the *reflection.* It is usually tricuspid, the *median cusp h* being much longer than the side *cusps f f.* These last are sub-obsolete in some species. All the cusps are in most cases surmounted by distinct *cutting points*;[2] *i* is the *median* cutting point, *g g* the *side* cutting points. These cutting points are not always present on the side cusps, and, even when present, are sometimes not readily detected. Indeed, this is the most difficult point of study of the whole membrane. The cusps and cutting points vary in development in the various species, and somewhat so in different portions of the same membrane. It must also be borne in mind, while studying my figures of the teeth, that the median cutting

Fig. 4.



Central tooth of *Strophia incana.*

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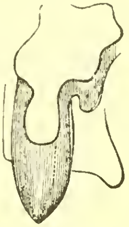
[1] I use the term *upper* and *lower* to describe the figure I give of the base of attachment. More properly I should say *anterior* and *posterior*, to describe their position on the membrane, in reference to the head of the moving animal.

[2] The cutting points are shaded in my figures.

point is flat on its lower surface, that is, the surface nearer the base of attachment, but from thence it first rises and expands greatly at its sides, and then gradually decreases in size as it still rises and arches over the top. Thus under the microscope there are two planes prominently seen by changing the focus of the instrument, the plane of the lowest portion of the cutting point, and the plane of its greatest expansion. In Fig. 5 the former is shown by dotted lines, the latter by the continuous line. In my illustrations the former alone is given. I regret not having shown both as done by Semper in Phil. Archip. l. c., especially as the plane of the greatest expansion often shows a lateral bulging representing the side cutting points in species deprived of distinct side cutting points.

Fig. 5.



First lateral of *Z. fuliginosus.*

The median cutting point seen on the plane of its greatest expansion, as in my figure, appears to spring from the median cusp itself, as if it were not distinct from it. A great deal has still to be done in elucidating the true character of cusp and cutting point.

The other type of tooth, which I call *aculeate* (see *Glandina*), differs in not having a quadrate base of attachment, but usually one of a somewhat sole-like form. Its upper margin is not reflected, but from its whole surface springs a single large cutting point, usually thorn-shaped, but sometimes more spine-shaped. The apex of the cutting point is sometimes bifid, or even trifid, even in the same genus.

Of these two types, quadrate and aculeate are all the teeth now known. Of the quadrate type many and dissimilar forms are known, but all have the quadrate base of attachment.

The characteristics of central, lateral, and marginal teeth are given under each genus or subgenus.

On Classification.

The characters of the jaw, combined with those of the lingual membrane, furnish reliable bases of classification. They have been considered of various weight by different writers. I here propose to treat them as guides only to the greater division of the Pulmonata.[1] In grouping the genera it will be necessary to include *all*, both native and foreign to America, in order to properly appreciate the value of this arrangement.

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[1] I must not be understood to propose a system of classification. I merely place the genera into certain groups, independent of their divisions into families.

Taking, therefore, the whole series of known Pulmonata Geophila, the first grand division is based on the absence or presence of a jaw. Of the former are the following: *Testacella,*[1] *Daudebardia,*[2] *Streptaxis,*[3] *Rhytida,*[4] *Diplomphalus,*[5] *Strebelia?*[6] *Glandina,*[7] *Petenia?*[8] *Spiraxis?*[9] *Streptostyla,*[10] *Ravenia?*[11] *Strepstostele,*[12] *Cœliaxis?*[13] *Gonospira,*[14] *Gibbus?*[15] *Ennea,*[16] *Vaginulus.*[17]

All the above have aculeate marginal teeth; the lateral teeth are always absent; the centrals in some of the genera.

The following genera have quadrate marginal teeth: *Onchidium,*[18] *Peronia,*[19] *Buchanania?*[20]

The second grand division contains those genera having a jaw. In this division also we find some genera with aculeate, and some with quadrate, marginal teeth.

Of the former are: *Limax,*[21] *Ibycus,*[22] *Parmacella,*[23] *Tennentia,*[24] *Mariella?*[25] *Parmarion,*[26] *Dendrolimax,*[27] *Phosphorax?*[28] *Urocyclus?*[29] (I know nothing of the position of *Othelosoma*, *Aspidorus*, and other problematical genera.) *Vitrina*,[1] *Vitrinoidea*,[2] *Vitrinopsis*,[3] *Nanina*,[4] and all the genera now recognized in its disintegration, *Stenopus*,[5] *Vitrinoconus*,[6] *Macrocyclis*,[7] *Zonites*.[8]

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[1] Heynemann, Malak. Blatt. X. Pl. II. Fig. 5.

[2] Goldfuss, verh. Naturh. Vereins der preuss. Rheinl. und Westphalens, 13th year, 1856, Pl. VI. Fig. *c. d.*

[3] Heynemann, Malak. Blatt. XV. Pl. IV. Fig. 2.

[4] Semper, Nachr. der deut. Malák. Gesellschaft II. 102.

[5] Fischer and Crosse, Journ. de Conch., XXI. 21, Pl. III. Fig. 8.

[6] Jaw and dentition unknown.

[7] See this work.

[8] Jaw and dentition not actually known.

[9] Jaw and dentition not actually known; as restricted, the genus may be more correctly placed near *Stenogyra.*

[10] Fischer and Crosse, Moll. Mex., p. 16, Pl. IV. Fig. 2.

[11] Jaw and dentition not actually known.

[12] Heynemann, Nachr. mal. Gesel. I. 20, 177, Fig. 5.

[13] Jaw and dentition not actually known.

[14] Bland and Binney, Amer. Journ. Conch., V. 37, Pl. XI. Fig. 1, photographed.

[15] No doubt like the last.

[16] Heynemann, Nach. Mal., Gesel. I. 20, 177, Pl. XX. Figs. 3, 4.

[17] See Stolicska, Q. Journ. As. Soc. Bengal. n. s. XLII. Pt. II. p. 33–37. The name Vaginulus is restricted by him to the agnathous species, while Veronicella includes those furnished with a jaw.

[18] Bland and Binney, Ann. Lyc. N. H. of N. Y., X. p. 340, Pl. XVI. Figs. 3–5.

[19] Quoy, Voy. de l'Astrolabe, Pl. XII.

[20] Jaw and lingual unknown.

[21] See this work.

[22] Heynemann, Malak. Blatt. X. 142, Pl. I. Fig. 3.

[23] Semper, Phil. Archipell., 90.

[24] Semper, l. c. 1, Pl. VI. Fig. 17.

[25] Ib. 12.

[6] Ib. 9, Pl. VI. Fig. 16.

[27] Heynemann, Malak. Blatt. XV. Pl. I. Fig. 1.

[28] Jaw and tongue not known.

[29] Heynemann, Malak. Blatt. 1866, 70, Pl. XI. as *Parmarion flavesceus.*

The following genera have quadrate marginal teeth. They may be readily grouped by the character of their jaw, which is either in one single piece (*A*), in one single piece with an accessory upper quadrate piece (*B*), or in numerous pieces (*C*).

A. Those whose jaw is in one single piece may again be subdivided into several groups based on the absence, presence, and peculiarities of the ribs on their jaw. This division, however, is unsatisfactory, as these characters are not always well marked.

(*a*) Jaw without ribs: *Philomycus*,[9] *Parmella?*[10] *Oopelta*,[11] *Sagda*,[12] *Patula*,[13] *Polymita*,[14] *Hemitrochus*,[15] *Helicodiscus*,[16] *Onchidella*,[17] *Acavus*, *Corilla*, *Caryodes*, *Panda*, *Labyrinthus*, *Caracollus*,[18] *Leucochroa*,[19] *Cysticopsis?*[20] *Plagioptycha*,[21] *Leptoloma*,[22] *Anostoma*,[23] *Anostomella?*[24] *Tomigerus?* *Boysia?* *Plectostoma?* *Hypselostoma?*[25] *Achatinella*,[26] *Clausilia*,[27] *Stenogyra*,[28] *Strophia*,[29] *Buliminus*,[30] *Balea*,[31] *Pupa*,[32] *Vertigo*,[33] *Ferussacia*,[34] *Cæcilianella*,[35] *Geostilbia?* *Azeca?* *Tornatella?*[36] *Zospeum?*[37] *Holospira*,[38]

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[1] See this work.

[2] Semper, l. c. 85, Pl. IX. Fig. 33.

[3] Ibid. 86, Pl. XI. Fig. 26.

[4] Ibid.

[5] Bland, Ann. Lyc. N. H. of N. Y., VIII. 158, Fig.

[6] Semper, l. c. 91, Pl. XI. Fig. 27.

[7] See this work.

[8] See this work.

[9] See this work.

[10] Jaw and lingual dentition unknown.

[11] Heynemann, Malak. Blatt., XIV. Pl. I. 2.

[12] Bland and Binney, Am. Journ. Conch., VI. 177.

[13] See this work.

[14] Bland and Binney, Ann. Lyc. N. H. of N. Y., X. 341, Pl. XVI. Fig. 1.

[15] See this work.

[16] See this work.

[17] See this work.

[18] See Semper, l. c. No doubt other genera of disintegrated *Helix* will be found to be grouped here. I propose at present to remove from *Helix* all the species not having ribs upon their jaw.

[19] Bland and Binney, Ann. Lyc. Nat. Hist. of N. Y., X. 220.

[20] Ibid., IX.

[21] Proc. Ac. Nat. Sc. Phila. 1874, 56.

[22] Ibid. 58.

[23] Journ. de Conch., XIX. 261, Pl. XI. Fig. 4.

[24] Jaw and dentition unknown.

[25] Jaw and dentition unknown.

[26] Bland and Binney, Ann. Lyc. N. H. of N. Y., X. 335, Pl. XV. Figs. 6, 7.

[27] Troschel, Moquin-Tandon, Lehmann, etc.

[28] See this work.

[29] See this work.

[30] But some species have ribs. See Moquin-Tandon, Lehmann, etc.

[31] Moquin-Tandon, Moll. Fr., Pl. XXV. Fig. 6.

[32] See this work.

[33] See this work.

[34] See this work.

[35] See this work.

[36] Unknown.

[37] Heynemann, Mal. Bl., X. Pl. III. Fig. 14. Jaw unknown.

[38] See this work.

Eucalodium,[1] *Cœlocentrum*,[2] *Lithotis*,[3] *Rhodea*, *Megaspira*,[4] *Limicolaria*,[5] but one species has a ribbed jaw, *Achatina*,[6] *Pseudachatina ? Perideris ? Columna ?*[7] *Bulimus* as now constituted has various forms of jaw.

(*b*) Jaw with decided stout ribs: *Anadenus*,[8] *Arion*, *Ariolimax*, *Prophysaon*, *Pallifera*, *Veronicella*, *Binneya*, *Hemphillia*, the genera of disintegrated *Helix*,[9] *Geomolacus*,[10] *Letournexia*,[11] *Peltella*,[12] *Xanthonyx*,[13] *Simpulopsis*,[14] *Pfeifferia*,[15] *Berendtia*,[16] *Carelia*,[17] and, as stated above, some species now included in *Bulimus*, *Cochlostyla*, *Buliminus*, *Limicolaria*.

(*c*) Jaw with separate, delicate ribs, usually running obliquely towards the centre: *Gæotis*,[18] *Amphibulima*,[19] *Bulimulus*, *Cylindrella*, *Macroceramus*,[20] *Pineria*,[21] *Partula*.[22]

B. The genera whose jaw is in one piece with an accessory quadrate piece are *Succinea*,[23] *Omalonyx*,[24] *Hyalimax*,[25] *Athoracophorus*.[26]

C. The genera whose jaw is in separate pieces are *Orthalicus*, *Liguus*, and *Punctum*.[27]

I have arranged the American genera in the same manner in the following pages.

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[1] See Crosse and Fischer, Journ. de Conch., 1870, Pl. V. Fig. 1.

[2] Jaw and dentition unknown.

[3] Binney, Proc. Phila. Ac. Nat. Sc. 1874, Pl. V. Fig. 3.

[4] Jaw and dentition unknown.

[5] Bland and Binney, Amer. Jour. Conch., VII. 181.

[6] Von Martens, ed. 2, p. 201.

[7] Jaw and dentition unknown.

[8] Heynemann, Malak. Blatt., X. 138, Pl. I. Fig. 1.

[9] See this work.

[10] Bland and Binney, Ann. of Lyc. of N. H. of N. Y., X. 309, Fig.

[11] Bourgignat, Moll. nouv. et lit., VII. 201, Pl. XXXIV. Figs. 1–7.

[12] Jaw apparently ribbed in Férussac's figure, Pl. VII. A.

[13] Fischer and Crosse, Moll. Mex., Pl. IX. Figs. 15. 16

[14] Shuttleworth, Diag., No. 6, p. 147.

[15] Mörch, Journ. de Conch., 1865, 385.

[16] Crosse and Fischer, Journ. de Conch., 1870, Pl. V. Figs. 11, 12.

[17] Binney, Pr. Phila. Acad. Nat. Sc. 1876, p. 185.

[18] Bland and Binney, Ann. Lyc. N. H. of N. Y., Vol. X. Pl. XI. Figs. 1, 5–7.

[19] Proc. Phila. Ac. N. Sc. 1874, Pl. VIII. Figs. 2, 5, 6. *Pellicula* is a synonyme of this.

[20] See this work.

[21] Bland and Binney, Ann. N. Y. Lyc. N. H., X. 22.

[22] Binney, Ann. Lyc. N. H. of N. Y.. XI. 45.

[23] See this work.

[24] Malak. Blatt., X. Pl. IV. Fig. 5, a.

[25] Fischer and Crosse, Journ. de Conch., XV. 218, Pl. X. Figs. 5, 7.

[26] Bergh, verh. kais. kœnig. zoolog. botan. Gesell. in Wien., XX. 844, Pl. XII. Figs. 2, 4, 5.

[27] See this work.

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The principal works on lingual dentition referred to are: —

Leidy in Binney's Terrestrial Air-Breathing Mollusks of the United States. Boston, 1851, Little & Brown. The wood-cuts of lingual membranes are misplaced in the text. See the list, Vol. II. p. 358.

Binney and Bland. Land and Fresh-Water Shells of North America. Part I. Smithsonian Miscellaneous Contributions. Washington, 1869.

Morse in Journal of the Portland Society of Natural History, 1864.

Moquin-Tandon. Histoire Naturelle des Mollusques Terrestres et Fluviatiles de la France. Paris, 1855.

Fischer et Crosse. Études sur les Mollusques Terrestres et Fluviatiles du Mexique et l'Amérique Centrale. Paris, 1874.

Lehmann. Die lebenden Schnecken und Muscheln der Umgegend Stettins und in Pommern. Cassel, 1873.

Goldfuss. Verzeichniss der bis jetzt in der Rheinprovinz und Westphalen beobachteten Land- und Wasser-Mollusken, nebst kurzen Bemerkungen über deren Zungen, Kiefer, und Liebespfeile. Von Verhandlungen des naturhistorischen Vereins der preussischen Rheinlande und Westphalens. 13 Jahrgang. Bonn, 1856.

Semper. Landmollusken. Reisen im Archipel der Philippinen. Wiesbaden, 1873.

Heynemann. Einige Mittheilungen über Schneckenzungen, mit besonderer Beachtung der Gattung Limax. Von Malako-zoölogische Blätter, X. 1862.

Von Martens. Die Heliceen von Joh. Christ. Albers. Zweite Ausgabe. Leipzig, 1860.

These are the principal works referred to. The references to shorter papers in various periodicals will easily be understood.

On the Illustrations of Dentition.

I endeavored in the paper already referred to, and in my subsequent papers, to give a good view of the central, lateral, and marginal teeth of each species, with the transition teeth of many of the species. The portion of the membrane chosen is different in the various species of each genus or subgenus, in order that the variations in the form and development of cusps and cutting points may be shown. Thus in some figures I have selected the part of the membrane where the marginal teeth have a very blunt cusp, while in others they are shown much more graceful. It must constantly be borne in mind that on any one membrane the teeth vary considerably in regard to this point.

In illustrating the general arrangement of the teeth upon the lingual membrane, I have used the wood-cuts in the text prepared for my former works and papers, mostly by Mr. Morse, and a few by Dr. Leidy, prepared for my father's work. It must be remembered that these figures do not represent correctly the characters of the individual teeth.

I have also used in the text figures of the jaws of many genera and subgenera, prepared for the Land and Fresh-Water Shells of North America, Part I. The jaws of the more recently described genera and subgenera I have myself illustrated from drawings by camera lucida.

On the Value of the Jaw and Lingual Membrane for the Purpose of Classification.

It is conceded by all recent students of land shells that for the larger divisions the presence or absence of a jaw and the aculeate or quadrate form of marginal teeth are reliable characters.

The characters of the jaw and separate teeth of the lingual membrane have also been used in various ways for grouping the genera into families, etc., and even of grouping species into genera. I refrain from any discussion of their value for such purposes, simply because I believe our material is far too limited. It seems as if I can better employ my time in patiently accumulating new facts. I can, however, venture to say that the character of the jaw and teeth seems to be more constant in some genera than in others. It appears, for instance, that in some genera the presence or absence of lateral teeth is not a generic character, though in others it is. The same may be said of the presence or absence of side cutting points to the centrals and laterals, and the greater or less development of their side cusps; also in the bifurcation or non-bifurcation of the cutting point of aculeate marginal teeth; also as to the presence or absence of ribs on the jaw.

It will, I believe, be proved that certain genera are constantly characterized by a peculiar form of teeth, while others have a considerable range of variation. I might, perhaps, add that when the genus is numerous in species, there is a much greater chance of finding a varying dentition. If this latter proves true, we shall be obliged to concede that there are certain types of teeth which may be found among species of some of the larger genera, though some of the smaller genera are much more, if not absolutely, restricted to one single type of dentition. I do not venture any further deductions at this time.

I will add that all the figures of dentition in the plates have been drawn by my own hand from the microscope itself, with the aid of the camera lucida.

IV. SPECIAL ANATOMY

The following pages are reproduced from the treatise on the subject by Dr. Leidy prepared for Volume I. I have added notes on the more recently discovered genera.

General Remarks upon the Exterior Form and Structure of the Terrestrial Naked Gasteropoda.

Upon examining a *Limax* or an *Arion*, we find it composed of a thick, vermiform body, with a broad, ribbon-like, pedal disk, running the whole length of its inferior surface. The anterior obtuse extremity forms the head; and from it protrude two retractile tentacula, and two retractile eye-peduncles, upon the outer side of the tip of the two latter of which is placed the eye. The mouth is situated at the antero-inferior part of the head; and immediately below it is a deep depression or blind sac. The posterior part of the body forms the tail, and is acute. Upon the antero-superior part of the body is placed the mantle, which covers the pulmonary chamber, and contains within it a rudimentary, laminar, calcareous testa or a congregation of calcareous grains. In other genera these are wanting. The anterior part of the mantle is free and movable, and the head, indirectly through the retractor muscle of the buccal body, is capable of being retracted beneath it. On the right edge of the mantle the pulmonary orifice exists; and at the posterior side of the latter the anal aperture is placed. Upon the right side of the head, a short distance posterior to the eye-peduncles of that side, the genital orifice is situated. The body has two distinct cavities, — the pulmonary chamber, containing a vascular network upon its surface, the heart, the renal organ, and the rectum; and the visceral cavity, separated from the former by a muscular partition, containing the digestive and generative apparatus and the nervous centres.

Ariolimax and *Prophysaon* have the same general arrangement as *Limax* and *Arion*. *Hemphillia* is distinguished by having its shelly plate external, its edge lightly imbedded in the mantle.

In *Tebennophorus* and *Pallifera* the mantle covers the whole upper surface of the body, and encloses no testaceous rudiment. Its anterior edge is unattached, and the head is retractile beneath it. The pulmonary chamber is placed beneath the anterior part of it; and the muscular membrane, bounding the visceral cavity in a great part of its extent, is but loosely attached to the outer integument.

In *Veronicella* the body appears broad from the mantle, which encloses the whole body except the comparatively narrow pedal disk, forming a lateral, angular projection as it is inflected inferiorly to the margin of the pedal disk. In transverse section it is semi-elliptical. The mantle contains no testaceous rudiment. The head can be but slightly protruded. The tentacles are bifid. The respiratory orifice is situated on the right side of the tail, between it and the extremity of the pedal disk. The anal aperture opens at the posterior margin of the latter orifice. The generative apparatus has two distinct external apertures, distant from each other. The male genital orifice is placed just beneath the mouth, between it and the blind sac, inclining to the right. The female orifice is situated upon the inferior part of the left side of the mantle, midway between the head and tail. As usual, the body has two cavities, of which the pulmonary occupies a position at the right posterior part, beneath the mantle, and extending backwards on the right to the tail.

Onchidium has a similar arrangement to *Veronicella*, but has no tentacles.

GENERAL REMARKS ON THE TERRESTRIAL TESTACEOUS GASTEROPODA.

A testaceous gasteropod resembles a slug with the greater portion of the viscera squeezed out upon the back, and arranged in a turbinate manner. The turbinate mass is always an exact mould of the testaceous covering of the animal; its length in the spiral direction holds no proportion with that of the foot, or that part of the body which the animal protrudes from the shell, and differs very much, not only in different genera, but also in different species of the same genus. With an increase in length a proportionate decrease in breadth is observable, and *vice versa.* In *Cylindrella* it reaches its maximum length and narrowness; in *Succinea* it has the minimum length, and the greatest proportionate breadth. When the foot is protruded from the shell, every part of the exterior surface of the turbinated mass is still in contact with the interior surface of the latter, and is retained so by means of the comparatively capacious pulmonary chamber. When the foot is retracted, it is at the expense of the latter cavity; so that the pulmonary chamber of the testaceous genera is as much larger than that of the naked genera as the size of the foot superadded, whilst the extent of the pulmonary network of blood-vessels remains the same.

The testacea have a muscle which is peculiar, namely, the retractor-muscle of the foot, which has its origin, in common with the retractors of the eye-peduncles and buccal body, from the columella of the shell. Narrow at its commencement, it increases in breadth, splits into several bands, and diverges as it descends to get its insertion into the whole of the inner margin of the excavation of the foot, excepting anteriorly, where its place is occupied by the retractor of the buccal body.

The head occupies the anterior portion of the foot, and in *Helix*, *Bulimus*, *Pupa*, and *Succinea*, etc., offers nothing peculiar from that of *Limax*. In *Glandina* a third pair of tentacular appendages exists. These are non-retractile, auriculate in form, and originate just postero-inferiorly to the base of the inferior, retractile tentacles, and project horizontally backward.

The body of the testacea, like that of slugs, has two great cavities. The visceral cavity includes the greater part of the turbinated mass and the excavation of the foot. The pulmonary chamber occupies a position on the outer side of the lower one to three whorls of the turbinated mass. The collar apparently takes the place of the mantle in slugs. In all the genera it is attached around the base of the turbinated mass, and is perforated on the right side by the pulmonary orifice. On the outer border of the latter the anal aperture is placed.

As in slugs, the genital orifice is situated on the right side of the head, more or less posterior to the eye-peduncles in the respective genera.

ON THE TEGUMENTARY COVERING OF THE TERRESTRIAL GASTEROPODA.

Besides a testa capable of enclosing the whole body, which most of the terrestrial Gasteropoda possess, they have a thick envelope, composed of mucous and muscular membrane. The exterior, highly irritable, and contractile investment consists of an actively secreting mucous membrane (Figs. 5, 6, 7, *1*) with a substratum of interlaced muscular fibres (*2*). In the naked genera it is pretty uniformly developed throughout, but is thickest upon the pedal disk, the tail, and the upper surface of the mantle, and thinnest upon the head, eye-peduncles, and reflected border of the mantle.

Fig. 5.

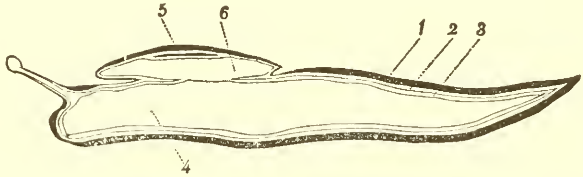

Fig. 5 is a diagram representing the disposition of the coverings of the body in *Limax* and *Arion*. *1*, mucous lamina; *2*, muscular substratum; *3*, muscular peritoneum; *4*, visceral cavity; *5*, rudimentary testa; *6*, pulmonary chamber.

Fig. 6.

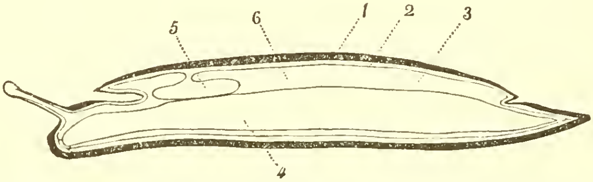

Fig. 6, disposition of the tegumenta in *Tebennophorus*. *1*, mucous lamina; *2*, muscular lamina; *3*, peritoneum; *4*, visceral cavity; *5*, pulmonary chamber; *6*, interval between the two muscular layers.

In the testaceous genera, upon the part of the body corresponding to the interior of the shell, it appears as if the mucous layer had been pushed downwards to form the collar (Fig. 7, *1**); but it may be still traced over the surface of the turbinated portion, as a delicate, tessellated epithelium.

The mucous glands are very numerous in the mucous layer; its epithelial cells are flattened, from three to six sided, granular, and with large, round nuclei.

The muscular substratum (Figs. 5, 6, 7, *2*) of the mucous lamina is composed of unstriped fibres, arranged transversely, obliquely, and longitudinally. It is inflected outwards beneath the mantle, in *Limax* and *Arion*, to form the outer parietes of the pulmonary chamber. Between this portion and the mucous layer is placed the rudimentary testa (Fig. 5, *6*). In *Tebennophorus* it is inflected inwards (Fig. 6, *5*) beneath the anterior portion of the mantle, to form the parietes of the pulmonary cavity. Its transverse fibres predominate within the eye-peduncles, its longitudinal fibres, in the exterior pulmonary parietes of the testaceous genera, and especially accumulate on the outside of and parallel to the rectum, so as to serve as an efficient agent in the retraction of the collar, and an aid in the expulsion of matters from the rectum.

Fig. 7.

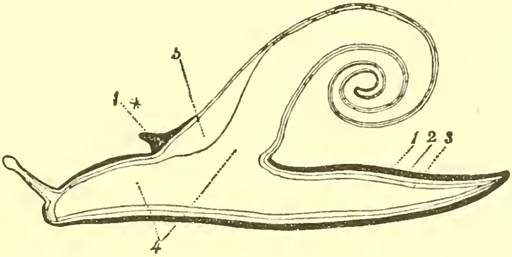

Fig. 7, disposition of the tegumenta in *Helix, Bulimus*, etc. The references are the same as in Figs. 5 and 6, except *1**, which is the collar.

Interior to the musculo-mucous investment of the body is a second covering (Figs. 5, 6, 7, *3*), which may be considered as a sort of peritoneum. It is a muscular membrane, and encloses the digestive and generative apparatus. It is usually pretty closely attached to the outer tegument, except in *Tebennophorus Caroliniensis*, in which the two are separated in all parts of the body, except above the pedal disk, where they are firmly blended together, as in all Gasteropoda. It forms the partition or diaphragm between the visceral and pulmonary cavities. This membrane is composed of transverse and longitudinal, unstriped, nuclear fibres, and is the origin of the especial retractor muscles of different organs.

Of the Digestive Apparatus.

Limax. The orifice of the mouth is bounded by a pair of contractile lips, is situated at the anterior part of the head, and opens into the cavity of the buccal body. When the latter is retracted by its peculiar muscle, the oral orifice becomes lengthened into a canal by the inversion of a portion of the external integument.

The buccal body is an irregularly oval-shaped, muscular organ, resembling in appearance a gizzard, and contains within it the masticatory apparatus. Just within the upper lip, attached to the entrance of the buccal body, is the dental plate or jaw, — a crescentic, corneous lamina, used for cutting the food. Its anterior face is convex, and presents several vertical ridges. Into its upper convex edge a band of muscular fibres is inserted, by the contraction of which the inferior, concave, cutting edge is advanced beyond the line of the upper. The middle of the cutting edge is extended into a short, conical beak. This jaw is brought into view when the animal is eating, by the advancement of the buccal body. The floor of the cavity is occupied with a gouge-shaped, muscular tongue,[1] the tip and upper surface of which are free, and are covered by a corneous lamina studded with a great number of conical dentures, with the points projecting backwards, arranged in transverse rows. These teeth preserve the same form in the lines from before backwards; the central line always differs from the others, and the teeth also vary gradually in form and size as they pass off from the central line laterally. They also vary slightly in form in different species. This lamina protrudes from the buccal body posteriorly, into a short, rounded, protuberant, blind sac, within which it appears to undergo a constant growth, as it is worn away by attrition anteriorly; for its use appears not only to facilitate the passage of the food onwards to the œsophagus, but also to act as a sort of rasp for triturating it, by means of the powerful muscles composing the buccal body. Into the posterior, inferior part of the buccal body, below the blind sac of the lingual lamina, is inserted, in a transverse, curved line, its retractor muscle. This muscle has its origin, in common with the retractors of the eye-peduncles, from the muscular investment of the visceral cavity, posterior to the pulmonary cavity, and to the right of the rectum.

The œsophagus proceeds from the upper, posterior part of the buccal body backward to the stomach. It is short, and dilates gradually into the latter.

The stomach is a capacious, membranous receptacle, when extended being two thirds the length of the animal. In *L. flavus* and *L. agrestis*, anteriorly it is dilated, and elongated-oval in form, posteriorly it is intestiniform. In *L. campestris*, it is nearly uniformly cylindrical throughout. Where the stomach terminates in the small intestine, it makes a turn forward with the latter, producing, in *L. flavus* and *L. campestris*, a sort of cul-de-sac posteriorly. Into the angle formed by the stomach and intestine, on each side, opens a biliary duct, which in *L. agrestis*, however, is more removed toward the small intestines.

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[1] See above, p. 45.

The intestine forms a single convolution among the lobes of the liver, and then passes obliquely forward from the left to the right side, to join the rectum. It is capacious, and pretty uniformly cylindrical throughout.

About the middle of the oblique portion going to join the rectum, in *L. agrestis*, opens a short, cylindrical cul-de-sac. In *L. flavus* the intestine, upon reaching the retractor muscles of the buccal body and eye-peduncles, winds around their origin, turns backward a short distance, and then again forward to the rectum, producing in this way a sigmoid flexure. From the termination of the latter in the straight portion, there proceeds backward as far as the termination of the visceral mass, a long, cylindrical cul-de-sac.

The rectum is short and straight, and penetrates into the pulmonary cavity, upon the right side of which it proceeds to the pulmonary orifice, at which it terminates by the anal aperture.

The salivary glands are two in number, flat, oval or irregular in outline, of a grayish-pink hue, and are situated upon the anterior parietes of the stomach. They are composed of several lobuli, which are conglomerated. From each gland proceeds a duct, along the œsophagus to the buccal body, into which they open on each side of the entrance of the œsophagus. In *L. campestris* the two glands are conjoined, so as to form a collar around the commencement of the stomach.

The liver, by far the largest viscus in the body, occupies a position at the posterior part of the latter. It is of a brownish color, and consists of two principal lobes, an anterior and a posterior, which are further divided, the anterior into three or four, and the posterior into two lobes. Each lobe is composed of a number of lobuli held together by blood-vessels. From the convergence of branches, an hepatic duct is formed for each principal lobe, which opens in the side of the angle formed at the termination of the stomach in the intestine. The posterior cul-de-sac of the stomach usually contains some bile, which is a thin, glairy, drab-colored fluid.

Arion. The digestive apparatus offers but little peculiarity from that of *Limax*. The retractor muscle of the buccal body is not so strong, and is divided into two lateral bands. The œsophagus is narrower and longer. In the form of the stomach and absence of a cul-de-sac to the small intestine, it resembles *Limax campestris*. The rectum, in its course to the pulmonary orifice, perforates the renal organ.

Tebennophorus. The buccal body has a conspicuous curve downwards, and the buccal pouch of the lingual lamina is longer than in *Limax* or *Arion*, and curves upwards from the postero-inferior part of the buccal body. The retractor muscle of the latter is split into two bands as in *Arion*, but one stronger. There are also two small retractor muscles to the lower lip. The œsophagus is comparatively long. The stomach is cylindrical and sacculated, and, posteriorly with the small intestine, forms a wide cul-de-sac. The small intestine is like that of *L. campestris* and *Arion*. The salivary glands occupy a position on each side of the œsophagus. The ducts are tortuous.

Prophysaon, Hemphillia, Ariolimax. In my descriptions of these genera I have included the digestive system, which has the same general arrangement as in *Limax*.

It appears that no generic characters may be found in the digestive system of the respective genera, excepting the jaw and lingual membrane, which are treated in full in Chapter III.

Veronicella. The buccal body possesses no retractor muscle. The dental plate, or jaw, is broad, and, upon the anterior surface, has a pectinate appearance, from the numerous ribs upon it. Its cutting edge is devoid of the conical toothlet. The œsophagus is moderately long and capacious. The stomach is cylindrical and sacculated, and posteriorly forms a deep, capacious cul-de-sac, independent of the small intestine. It is strongly muscular and shining, the transverse muscular fibres being very distinct. The anterior hepatic duct opens into the angle formed by the cul-de-sac and the intestine, the posterior into the fundus of the latter. The small intestine is pretty uniformly cylindrical, and holds the usual course to near its termination in the rectum, when to reach the latter it turns abruptly backward, and joins it on the right side, just posterior to the middle of the body. The rectum is straight, and proceeds backwards, along the right side of the body, within the pulmonary cavity, and terminates between the extremity of the tail and the pedal disk, at the side of the pulmonary orifice. The salivary glands are arborescent, or fasciculated in appearance. The ducts are short and delicate. The lobuli of the liver are looser, or more separated, than in the preceding genera.

The Genera of Disintegrated Helix. The buccal body has the same appearance, generally, as in the slugs. The retractor muscle is much stronger, and has its origin in common with the retractor of the foot and eye-peduncles, from the columella of the shell; at its insertion it forms a semicircle around the posterior inferior part of the buccal body. The pouch of the lingual lamina is always a prominent object. In *Zonites cellarius* and *Macrocyclis concava*, the buccal body is proportionately nearly twice the length of that of the other species, denoting a carnivorous habit, as in *Glandina*. The dental plate, or jaw, varies in some degree in different species: in *Zonites*, *Macrocyclis*, etc. it is smooth anteriorly, and in the middle projects downwards into a large conical toothlet; in *Mesodon*, *Triodopsis*, etc. the anterior surface presents a number of curved ribs, each of which projects inferiorly as a sort of toothlet, denticulating either margin.

The œsophagus is generally long and narrow. In some species it is unusually long and contracted, as in *M. concava*, *Z. cellarius*, *Stenotrema hirsutum*, *Patula perspectiva*, etc.; in others it is long, and dilated in the middle, as in *Polygyra auriculata;* in many it is capacious, and gradually passes into the stomach, as in *Mesodon exoleta*, etc. It is exceedingly long in *Polygyra septemvolva.*

The stomach is usually cylindroid, and more or less sacculated. The posterior cul-de-sac is always present.

The small intestine comes off from the stomach at a very acute angle, and into the latter two hepatic ducts empty. It is pretty uniformly cylindrical, and forms, as in slugs, a single convolution or a sigmoid curve, among the lobes of the liver, and penetrates to the pulmonary cavity at its right posterior angle. The rectum, in all the testaceous genera, corresponds in length to the pulmonary cavity, the right side of which it occupies to the pulmonary orifice, at the outer border of which it terminates by the anal aperture. It is cylindrical, usually wider than the small intestine, and is frequently somewhat sacculated. Upon the outer side of the rectum, running its whole length, is a band of muscular fibres, the object of which is, apparently, the retraction of the collar, the shortening of the rectum, and the expulsion of its contents.

The salivary glands are generally elongated, oval, with lobed edges. They are usually united together and situated on the œsophagus, or commencement of the stomach. When the œsophagus is narrow they surround it; when dilated, they occupy one half or two thirds of its surface. The salivary ducts are long and large.

The liver is four-lobed, three of which lobes are anterior or inferior, and the fourth posterior or superior. The fourth lobe, conjoined with the testicle, forms the very summit of the turbinated mass. The ducts from the anterior lobes converge to form a single trunk, which, with that from the posterior lobe, open into the junction, or angle, of the cul-de-sac of the stomach with the intestine.

Binneya. The œsophagus is very short; the stomach very wide, short.

Bulimulus. The digestive apparatus in *B. dealbatus* and *B. multilineatus* resembles that of *Polygyra auriculata ;* the œsophagus is long, narrow, and dilated in the middle; the stomach is cylindroid, and more or less sacculated.

Stenogyra. The digestive system is like the last.

Liguus. The stomach of *Liguus fasciatus* resembles that of *Limax flavus*, being large and capacious anteriorly, cylindrical and sacculated posteriorly. The rectum is capacious and sacculated.

Orthalicus. The digestive system of *undatus* is as in *Liguus.* It does not essentially differ from that of the genera of disintegrated *Helix.*

Pupa. A characteristic of this genus is the very great proportionate length of the viscera, corresponding to the numerous whorls of the shell. The retractor muscle of the buccal mass is long and strong. The œsophagus is very long and narrow. The stomach is very long, and even forms a fold upon itself. The rectum is very long and sacculated; the muscle on its outer side is well developed.

Succinea. A characteristic of this genus, the reverse of *Pupa*, is the great breadth and shortness of the viscera. The dental plate, or jaw, has an upper quadrangular piece, superadded to the ordinary crescentic plate. The stomach resembles that of *Limax flavus.* Its mucous membrane presents several longitudinal rugæ. The small intestine does not undergo the same relative diminution with the other viscera. The rectum is very short, and, from the transverse position of the pulmonary cavity, it is placed along the right of the breadth, instead of the length of the latter, as usual. The salivary glands are situated one on each side of the commencement of the stomach; their ducts, just before opening into the buccal body, become dilated.

Macrocyclis. The buccal mass, as stated above, is twice the size of that of the other genera.

Glandina. The oral orifice is triangular, and bounded by three papillated lips, one upper and two lateral. The buccal body is a very long muscular cylinder, a little curved downward at the posterior part. There is no cul-de-sac for the lingual lamina protruding behind; and the retractor muscle is divided into three fasciculi, one central and passing into the buccal body posteriorly, the others lateral and inserted as usual. Externally, it has a very thin investment of longitudinal muscular fibres, continuous with those of the retractor muscle and the origin of the especial muscles of the tongue. This layer is very delicate and transparent; and at the anterior third of the buccal body, laterally and inferiorly, it presents several fasciculi, which pass to the tegumentary lips. Beneath the exterior covering, and readily seen through it, is a thick and strongly fasciculated, transverse layer of muscular fibres. When the buccal body is laid open the oral orifice is found to be continuous with a triangular canal with smooth sides, running one third its length. At the posterior superior termination of the canal is the opening of the œsophagus and orifices of the salivary ducts. There is no dental plate, or jaw. The posterior two-thirds of the buccal body is occupied by a long oval organ, composed of numerous, strong fasciculi of muscular fibres, arising laterally and inferiorly at the posterior part of the buccal body; the former passing inwards and forwards, the latter forwards to the anterior extremity of the organ, which is free, and projects into the triangular, oval canal. The lateral fasciculi leave between them superiorly an interstice, at the bottom of which is found the lingual membrane, in the form of a tube, closed posteriorly, and open and reflected downwards and backwards upon the anterior, free tip of the organ. Into the posterior extremity of the lamina the middle fasciculus of the retractor muscle of the buccal body is inserted; and, just anterior to this insertion, a small, attrahent fasciculus, arising from the roof of the buccal body, posterior to the orifice of the œsophagus, which gets to the lamina by means of the interstice of the muscular organ superiorly. The teeth of the lingual membrane are arranged diagonally, from the middle line, in parallel rows, passing from within outwards, as shown in the descriptive portion of this work.

The œsophagus issues from a fissure at the upper posterior line of the anterior third of the buccal body. It is long and cylindrical, and rather wider at its termination than at its origin. The stomach is irregularly cylindroid, and has a cul-de-sac at its commencement, projecting anterior to the entrance of the œsophagus. The small intestine is capacious.

The salivary glands are conjoined, so as to form a circular collar around the posterior part of the œsophagus. The salivary ducts are long, and enter the same fissure of the buccal body at which the œsophagus issues. The anterior lobes of the liver are comparatively very small, while the posterior lobe is correspondingly large; and to the whole there is but a single duct.

Observations on the Tissues of the Digestive Apparatus.

The mucous membrane of the alimentary canal is usually smooth throughout. In the stomach it frequently presents a number of transverse folds, corresponding to the contractions which produce the sacculated appearance of the organ; and in several species of different genera it presents a few longitudinal rugæ, as in *Limax flavus*, *Liguus fasciatus*, *Mesodon exoleta*, etc. In its whole extent it is formed of a columnar epithelium and a nucleolated-nucleated basement membrane. The columnar cells of the epithelium are long and pyramidal, the upper part or base being broad, and the attached extremity very narrow. They are filled with a very fine, indistinct, granular matter, intermingled with coarser, highly reflective granules. Each contains an oval, granular nucleus, with a minute nucleolus.

The muscular investment of the intestinal canal is strongest upon the stomach and rectum. In *Veronicella*, *Strophia incana*, etc. it is strong and shining upon the stomach. It consists of two layers, an internal transverse and an external longitudinal. They are both composed of white, shining, strap-shaped bands, with the extremities pointed and closely adapted to each other. None of the transverse bands surround the stomach, all being much too short. They are indistinctly granular in structure, and each contains one or two elongated nuclei.

The lobules of the salivary gland are composed of the dilated commencements of the ducts, lined with soft, glanular cells, which are oval in form, and contain a round, granular nucleus with a minute nucleolus. The basement membrane of the salivary ducts is amorphous. The epithelial cells lining the trunks bear considerable resemblance to those found in their follicular commencement. Outside of the basement membrane, twine narrow muscular fibres in various directions. They are nucleated, and where the nuclei exist are wider than at the intervening parts.

The lobuli of the liver are composed of the rounded commencement of the biliary ducts, and are lined with polygonal cells, which become globular on the removal of pressure. The hepatic cells contain a fine, granular matter, fine and large oil-globules, and a round, nucleolated nucleus.

Of the Generative Apparatus.

All the terrestrial Gasteropoda under consideration are monœcious or hermaphroditic, though none are capable of self-impregnation. They are also mostly oviparous.

Their genital system is complicated, and liable to such variation in its details as to furnish excellent generic and specific characters. I have therefore, when possible, given descriptions of the system in the descriptive portion of my work, under each species. I will here give only a general description of the development of the system :—The testicle is a single globular mass of aciniform cœca in some genera; in others it is composed of numerous fasciculi of long cœca : it is free, or imbedded in the upper lobe of the liver; its position, as well as the shape of its cœca, being different in the respective genera.

The epididymis is an undulated, or moderately tortuous tube, leading from the testicle to the inner side of the junction of the ovary with the prostate gland. It opens into a groove upon the inner side of the interior of the oviduct, which is continuous, at its inferior extremity, with the vas deferens. Opening into the termination of the epididymis, and lying against the inner side of the ovary, is a small, compound, follicular body, which appears to be common to all the terrestrial Gasteropoda, and is known as the accessory gland of the epididymis. The prostate gland is a white or cream-colored body, occupying the inner side of the whole length of the oviduct. It has a transverse, striated appearance, and numerous openings into the groove leading from the epididymis to the vas deferens.

The vas deferens is a comparatively short tube, passing from the prostate gland to the penis sac. The position of its junction forms a specific character; sometimes it joins the summit of the latter, at others it enters near the base.

The penis sac is generally a long, cylindroid, irregular body, lying at the right anterior part of the visceral cavity, and joining at its termination a short cloaca. Its form is, however, very variable, and is an excellent specific character, as is also the point of insertion of the retractor muscle, which has its origin from the muscular investment of the visceral cavity, just posterior to the position of the pulmonary cavity. The penis sac often has a flagellate appendage containing the curious organ known as the capreolus. The above are the male organs of the compound system.

The female organs consist of the ovary, a linguiform body, sometimes lobulated, at the posterior end of the genital system. The oviduct is a long sac-like body, usually greatly convoluted in its course. It decreases in breadth at its anterior end, and gradually merges into the vagina, a long tube-like body of uniform size to the common external orifice; into its lower end, called by Dr. Leidy the cloaca, enters the penis sac, and above this enters also the duct of the genital bladder. This last organ, as well as the bladder itself, varies greatly in size and length, and forms an excellent specific character.

The above is the simplest form of the genital system, all these organs being absolutely necessary. It is often much more complicated by having an accessory, very much lengthened duct to the duct of the genital bladder, by various forms of vaginal prostate glands, often with complicated accessories; with one or more dart sacs entering into the vagina, containing a dart of various shape. The penis sac also sometimes has curious and varied accessories. All these organs may be found in some species of any given genus, while other species may have only the organs necessary to the genital system.[1] I am induced, therefore, to consider the details of the generative system to be only a specific character. As a generic character we can rely only on the position of the external orifice of the system, and on the position of the testicle as well as the form of the cœca which compose it. Thus *Glandina*, *Zonites*, and *Ariolimax* have the external orifice under the mantle, while usually it is found behind the right eye-peduncle. Again *Limax*, *Ariolimax*, *Prophysaon*, *Hemphillia*, *Arion*, *Glandina*, and *Succinea* have the testicle free, and formed of aciniform cœca, while in the genera of disintegrated *Helix* and others it is composed of fasciculi of elongated cœca commingled with the substance of the upper lobe of the liver.

GENERAL REMARKS UPON THE JUNCTION OF DIFFERENT PORTIONS OF THE GENERATIVE APPARATUS, AND THE STRUCTURE OF ITS TISSUES.

The testicle was mistaken by Swammerdam, Cuvier, and others for the ovary, and the latter organ and prostate gland for two portions of the testicle. A microscopic examination of these different organs at once very easily settles their true nature; although, even without this mode of analysis, we would suppose the epididymis would indicate the character of the gland of which it is the duct, and leave the remaining two organs to be considered as belonging to the female apparatus. In *Helix* the structure of the testicle consists of dense fasciculi of short cœcal pouches, which are simple, bifurcate, or trifurcate. These contain polygonal spermatophori, which are finely granular with a round nucleus, or filled with granular globules of uniform size, or with coils or bunches or fasciculi of spermatozoa. The epididymis always contains, more or less, and is frequently distended with, a white, silky, filamentous substance, composed of spermatozoa. The latter consist of very delicate and, comparatively, enormously long filaments, terminating, at one extremity, in a thickened head. They vary in length in different species of these gasteropods. The head assumes two principal forms; it is either sigmoid and pointed, as in *Mesodon albolabris, Mesodon multilineata*, etc., or else it is spiral and pointed, as in *Patula alternata, Patula solitaria*, etc. In the vas deferens the spermatozoa may often be detected in movement, which is slow and vibrating in character.

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[1] For instance, in *Arionta* we find the necessary organs only in *Townsendiana*, but in *Nickliniana* and other species a great variety of accessory complications.

The prostate gland, although situated along the tract of the oviduct, evidently belongs to the male apparatus, as is proved by its emptying solely into the vas deferens in *Veronicella*, and in its being placed between the termination of the epididymis and the commencement of the vas deferens only, as is very conspicuously observed in *Succinea.* In structure, it is composed of closely packed, tortuous, tubular, simple follicles, lined with short, thick, pyramidal epithelia, which are densely granular, and contain a round, nucleolated nucleus. The object of this organ probably is to dilute the very tenacious spermatic matter as it oozes from the epididymis into the spermatic groove on the inner side of the oviduct.

In all the terrestrial gasteropods examined, there was found a small glandular body, from which proceeds a short duct to join the termination of the epididymis. It consists of from two to nine rounded follicles joining a common duct, and, from the constancy of its existence, must be deemed important.

The ovary is soft and homogeneous in appearance; viewed by the microscope, it is found to be almost wholly composed of immature ova, polygonal cells with a germinal vesicle and macula.

The sides of the oviduct are soft, and in great measure composed of a tissue consisting of large polygonal cells, with from one to five small round nuclei.

The organ denominated genital bladder, from its opening into the vagina, or at the termination of the latter, and in *Veronicella* from its belonging almost wholly to the female organs, must be considered rather as a portion of the female apparatus than a prostatic sac, as it is called by Owen. By many authors this has been termed the spermatheca, from its supposed function of holding spermatic fluid received from the male organs, and with some reason; for in several instances I have found it to contain a tenacious mass, which upon microscopic analysis was found to be composed of spermatozoa. This cannot, however, be considered wholly as its use; for it secretes a mucoid matter, which may probably facilitate the passage of the ova through the vagina and cloaca. The mucoid matter within the bladder is frequently found to contain immense numbers of an infusorial parasite, which has been described under the name of Cryptoicus.[1]

The epithelium of the bladder consists of very long, caudate, columnar cells, with elliptical, granular nuclei, and a small round nucleolus.

In comparison of the descriptions of genitalia in this work with those given by foreign authors, it must be remembered that the terms ovary, testicle, etc., are not applied to the same organ.

In Vol. I. will be found figures of the genital system of many of our species. I have in this volume repeated the descriptions, under each species, and given figures of many not included in the plates of Vol. I.

OF THE RESPIRATORY AND CIRCULATORY APPARATUS.

The lung of the Terrestrial Gasteropoda is a simple cavity, with an orifice communicating with the exterior, upon the right side of the body. The surface of this pulmonary cavity in part of its extent, and more particularly near the pulmonary orifice, is covered by a close intertexture of blood-vessels. The blood of the body is conveyed directly to the lungs by two principal vessels, the pulmonary arteries, which join the capillary rete of the pulmonary surface. From this rete passes off the pulmonary vein to the heart, which is systemic, and consists of an auricle and ventricle. The auricle receives the pulmonary vein; from the ventricle passes off the aorta, to be distributed throughout the body.

LIMAX. The pulmonary cavity is situated beneath the mantle, and has nearly the same size and form. It is separated from the visceral cavity by the muscular peritoneum, but contains the rectum, renal organ, and heart. The pulmonary orifice is situated at the antero-inferior edge of the mantle, on the right side of the body. When open it appears round; it is closed by means of circular muscular fibres. The pulmonary rete is principally displayed upon the roof of the cavity, and from it converge three principal trunks, to form the pulmonary vein which passes to the auricle of the heart.

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[1] Journ. Acad. Nat. Sci. Phila. N. S. Vol. I.

The heart, enclosed within a pericardium, is situated near the middle of the pulmonary cavity. The auricle and ventricle are pyriform, and placed base to base. The sides of the latter are considerably thicker than those of the former, and present internally several well-marked fasciculi, crossing in different directions. Between the auricle and ventricle is a double valve. From the apex of the ventricle passes off the aorta, which pierces the muscular peritoneum, and divides into two principal branches, — one passing to the sub-œsophageal ganglia devoted to the viscera in the anterior part of the visceral cavity, the other passing to supply the viscera posteriorly. Upon the right of the heart, attached to the roof of the pulmonary cavity, is placed a large glandular organ, considered as the kidney; from the whole of its right margin proceeds a duct backwards, which then curves to the side of the rectum, at the left side of which it remains attached to the pulmonary orifice.

Arion. The pulmonary cavity is situated as in *Limax*. Its whole interior surface presents an intricate rete, from which converge six or seven pulmonary veins to the auricle of the heart.

The renal organ forms a complete circle around the heart, and is perforated by the rectum, in the course of the latter to the pulmonary aperture.

Tebennophorus. The pulmonary cavity is situated beneath the anterior portion of the mantle. It is formed by an inflection of the muscular layer of the integument of the body. The renal organ is placed to the right of the heart, and at its posterior part is perforated by the aorta.

Veronicella. The pulmonary cavity is situated between the muscular peritoneum and the integument of the body. Its principal portion is placed upon the right side, anterior to the middle, but extends to the left side, over the back, and along the right side to the pulmonary aperture, between the tail and posterior extremity of the podal disk. The heart is placed in the anterior portion of the cavity. The auricle receives a vein from the right and another from the left side.

The renal organ is placed posterior to the heart, between the passage leading from the pulmonary cavity to its orifice, and the course of the rectum.

THE GENERA OF DISINTEGRATED HELIX. In this genus, as is also the case in all the testaceous genera under examination, the pulmonary chamber is comparatively very large, for reasons already stated, and occupies a position on the outside of the lower one or two whorls of the turbinated mass of the viscera. In front, it is bounded by the collar, in the right side of which is the pulmonary orifice. The floor of the cavity is formed, as in slugs generally, by the muscular peritoneum. The roof, or outer wall, is occupied on the right side by the rectum, posteriorly by the heart and renal organ, and anteriorly by the pulmonary rete of capillary vessels. The pulmonary rete is most developed in the vicinity of the pulmonary orifice; and from it in a line with the latter, along the course of the rectum, proceeds backward a single pulmonary vein to the heart. The renal organ is elongated, pyramidal, and is placed to the right of the heart and pulmonary vein. Its duct commences upon the right border of the gland, courses backward to the rectum, along the inner side of which it passes to the pulmonary aperture.

The remaining testaceous genera present nothing peculiar in the character of the pulmonary or circulatory apparatus.

GENERAL REMARKS. The heart, in warm weather, beats about fifty-five times in a minute, but to some extent appears to be under the control of the animal, for if disturbed or irritated it pulsates much slower.

In composition, the heart consists of distinctly granulated, unstriped muscular fibres, with oval nuclei, which are hardly visible before the application of acetic acid to them.

The interior of the heart and aorta is lined with a tessellated epithelium; and the exterior of the former and interior surface of the pericardium are covered by the same. The cells are granular, with distinct, round, or oval, granular nuclei, and a minute nucleolus.

The pericardial epithelium separates its peculiar fluid very freely, the pericardium frequently appearing distended with the liquor pericardii. In the testaceous genera it frequently contains numbers of an entozoon, which Dr. Leidy has named *Distoma vagans*.[1] The blood-vessels, especially in the liver, exhibit a white opaque appearance, which is dependent upon the deposit in the sides of the vessel of innumerable, oil-like granules.

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[1] See Journal Acad. Nat. Sci. Phila., New Series, Vol. I.

The blood contains numerous blood-corpuscles, which vary in size, are granular, and exhibit numerous radiating, projecting points of variable length, — frequently greater than the diameter of the corpuscle.

The pulmonary cavity is lined with a tessellated epithelium, the cells of which are faintly granular, with a few coarser granules, and a distinct, round or oval, granular, nucleolated nucleus.

The renal organ is a gland which exhibits a foliated or plicated appearance, within a capsule. The surfaces of the plicæ communicate with the duct existing along the whole right border of the organ, and are covered with polygonal, organic cells, every one of which contains a large, white, round, opaque mass, resembling uric acid in appearance.

On the Nervous Centres, and the Distribution of the Nerves.

The nervous centres consist of three distinct sets of ganglia, which are all placed within the anterior part of the body or head.

The first set, or supra-œsophageal ganglia, form a transverse band, above or in front of the buccal body, usually at its anterior part, but varying in the latter position, to some degree depending upon the movements of the buccal body. When the latter is protruded, the band of ganglia is thrown back to the commencement of the œsophagus; when retracted, it is placed just behind the upper lip. It consists of two symmetrical halves united by a short transverse commissure. Each half is composed of several ganglia, aggregated to a greater or less degree in different genera and species. Sometimes they are so aggregated, or are so covered by enveloping tissue, as to appear a single mass; in others five or six distinct masses may be readily counted.

The second set, or sub-œsophageal ganglia, form a circular mass, placed infero-posteriorly to the buccal body, in the excavation of the foot. It is asymmetrical, and is composed of several ganglia, more or less aggregated together; from four to seven masses can generally be counted. It is usually more developèd upon the right than the left side, and passes through all the shades of color, in different genera and species, from white and yellow to orange. Through the opening formed by the arrangement of the ganglia into a circle passes the cephalic branch of the aorta. The supra-œsophageal and sub-œsophageal ganglia are connected together on each side of the buccal body by a double commissure, which varies in length in different genera; thus, in *Helices*, etc., it is generally so long as to allow of much movement of the supra-œsophageal ganglia forward with the buccal body, while in *Veronicella* it is so short that the two sets of ganglia form a close ring around the anterior part of the buccal body.

The third set of ganglia are the stomato-gastric, consisting of two minute lateral masses, united by a short transverse commissure, and always placed upon the buccal body immediately postero-laterally to the commencement of the œsophagus. The stomato-gastric ganglia are connected with the supra-œsophageal on each side, by means of a long, delicate commissure, which is more or less loose, and permits a free movement of the former ganglia with the buccal body to which they are fixed.

From the supra-œsophageal ganglia pass off on each side, — 1st, a minute branch along the course of the supra-sub-œsophageal commissure; 2d, three or four small branches to the retractor muscles of the eye-peduncles; 3d, a large branch, the superior tentacular nerve; 4th, one or two small branches to the base of the eye-peduncle, for its integument; 5th, the inferior tentacular nerve; 6th, small branches to the integument of the lips.

From the sub-œsophageal ganglia pass off, — 1st, numerous branches on each side, to the podal disk, and laterally to the integument; 2d, a branch on the right side to the penis; 3d, a branch to the vas deferens and prostate gland; 4th, on each side a branch to the retractor muscle of the buccal body; 5th, a large one to each side of the collar and pulmonary chamber; 6th, a branch which follows the posterior aortic vessel, which gives off branches to the muscular peritoneum; 7th, branches to the origin of the tentacular retractors; 8th, branches to the oviduct, ovary, testicle, stomach, intestine, and liver.

From the stomato-gastric ganglia pass off on each side, — 1st, a nerve to the external muscular structure of the buccal body; 2d, two branches which penetrate posteriorly into the buccal body; 3d, a branch to the salivary duct and gland; 4th, a branch to the œsophagus and stomach; 5th, branch to the interior of the buccal body anteriorly.

The above distribution of the nerves has been principally derived from dissections of *Glandina* and *Mesodon albolabris.* In the former genus, upon what is the nerve to the tentacle in the other genera, there is formed, near the base of the eye-peduncles, a ganglionary enlargement, from which passes off the true, inferior tentacular nerve of this animal, and two other large branches to the third, or external tentacle.

The nervous centres are composed of ganglion globules, varying very much in size; some are very large, others are not more than one eighth the diameter of the larger ones and nuclear bodies. The globules are more or less polygonal, from mutual pressure, are distinctly granular, and contain a nucleus which is comparatively of enormous size. The latter usually fills one half or two thirds of the cell or globule, is more distinctly and darkly granular, and contains from one to seven small, round, transparent nucleoli. The separate nuclear bodies resemble the nuclei of the ganglion globules, but are much smaller, and contain but a single nucleolus. The nerve-fibres pass through the ganglionary centres, among the globules in every direction; but none of them appear to originate or terminate in the latter. None of the ganglionary cells are caudated.

The nerves consist of bundles of tubuli, containing an oleo-albuminous matter, which in the fresh nerve is semi-fluid, faintly granular, homogeneous, and translucent, but after the matter is pressed out of the tubuli it separates into two portions, one of which is a tenacious, fluid substance, containing the other in the form of oil-like globules of no determinate size. The wall of the tubuli is amorphous and transparent, and has attached to it, and projecting externally, oval, granular nucleolated nuclei.

The nerves, especially in those emanating from the supra-œsophageal ganglia, are enveloped in a sheath formed of large, elongated, polygonal, transparent cells, containing in the centre an oval nucleus surrounded by a mass of coarse granular bodies, which are endowed with a very active molecular movement.

On the Organs of Especial Sense.

Touch. The soft, mucous integument is very irritable; but tactile sensibility is most developed in the tentacula and eye-peduncles, which are two pairs of tubular prolongations of the external integument, from the anterior part of the body or head. The superior pair, or eye-peduncles, are several times longer and thicker than the inferior pair. They are conico-cylindroid in shape, with the free extremity or point dilated, or bulbous, in the outer side of which the eyes are placed. The inferior pair, or tentacula, are short, conico-cylindroid, and slightly bulbous at the point.

The integument is thick at the base of the tentacula, but gradually becomes thinner as it approaches the free extremity, where it is delicate and transparent. The color is the same on the general investment of the body, except at the free extremity of the tentacula, where, from its transparency, the structure beneath shows through, and appears whitish. On the eye-peduncles it is rougher than upon the tentacula, from the polygonal folds being deeper. It is but loosely attached to the parts within, except at the free extremity, where it becomes firmly united.

The retraction of the eye-peduncles takes place by means of the contraction of the retractor muscle, which forms within them a cylindrical tube, and is inserted into the integument at their free extremity, so that when they are retracting the integument becomes inverted, and the point of the eye-peduncle first disappears from view and, in protrusion, is last to appear. The latter movement takes place through the relaxation of the retractor muscle, and the gradual contraction of the circular muscular fibres forming the basis of the integument, commencing at the base of the eye-peduncle and proceeding towards the free extremity, by which course of movement the latter is pushed out.

Within the tube of the retractor muscle of the eye-peduncles, passes to the free extremity of the latter the tentacular nerve. When the eye-peduncles are retracted, the nerve becomes tortuous and spiral, but when fully protruded it is nearly straight or merely undulated.

Near the free extremity of the eye-peduncles, the nerve undergoes a sudden constriction, and then dilates into a gangliform enlargement, from the outer side of which proceeds a small division of the tentacular nerve, as the optic nerve, to the eye. The gangliform enlargement is composed, on the exterior, of the nerve-tubuli of the tentacular nerve, and on the exterior, of a soft, white, finely granular matter, containing, in the exterior layer, round, granular, nuclear bodies. Anteriorly, the enlargement undergoes a constriction, and then dilates into the large bulbous mass of the extremity of the eye-peduncles. This latter mass is white, soft, and finely granular. Upon its exterior the nerve-tubuli of the exterior of the first gangliform enlargement diverge, and divide into a number of large branches, which laterally subdivide into numerous smaller branches, and thus enclose the granular mass.

The tentacula present the same nervous structure, except that there is no well-marked constriction between the tentacular nerve and the first gangliform enlargement, nor between the two enlargements, nor is there any optic nerve.

The space between the tentacular nerve and the retractor muscle is filled with a filamentous tissue, containing round, granular, nucleolated nuclei, and large, round or elliptical, transparent cells, with nuclei similar to those which lie free in the tissue.

The integument of the eye-peduncles is very freely supplied with nerves from the supra-œsophageal ganglia.

TASTE. If existent, it is probably dependent upon nerves distributed within the buccal body, and derived from the stomato-gastric ganglia. The structure of the lingual membrane precludes any idea of its existence there.

SMELL. The presence of this sense is undoubted, though there is much discrepancy of opinion as to its situation. I have suspected that it probably may be placed in the blind sac, or depression, which opens just below the mouth. This sac varies in its degree of development in the different genera: in *Limax* it is a superficial depression; in *Vaginulus* it extends backwards beneath the buccal body for half an inch, is conical in shape and yellowish-white in color; in *Liguus fasciatus* it extends back, in the excavation of the foot, to the tail, and is folded several times upon itself.

HEARING. The acoustic apparatus consists of a pair of transparent vesicular bodies, placed upon the postero-inferior part of the sub-œsophageal ganglia, one on each side. They are placed in a depression of the ganglia formed by a separation of the nerve-tubuli as they pass from and into the latter, immediately upon the ganglionic globules. Their interior is filled with a transparent fluid, containing numerous otoconites, which vary in size, are oval in form, transparent, composed of concentric layers of carbonate of lime, and frequently have a small cavity in their centre. During life, and for a short time after the death of the animal, the otoconites are endowed with a peculiar vibratory movement, by which they are disposed to accumulate into a mass in the centre of the auditory vesicle. After the cessation of the movement they become diffused through the fluid of the vesicle.

SIGHT. The eyeball is placed beneath the integument, on the outer side of the constriction which exists between the gangliform swellings at the free extremity of the eye-peduncles. The optic nerve is derived from the inferior part of the first gangliform enlargement, is tortuous or undulating, and reaches the eyeball at its posterior part. Its course is frequently indicated by a deposit of pigmentum nigrum.

The eyeball is globular, and is invested exteriorly by a transparent tunic, corresponding to the sclerotica and cornea.

The choroidea forms two thirds of a sphere, and is inflected anteriorly into a sort of depressed disk, perforated in the centre. It consists of a delicate, translucent membrane, with a deposit of a single layer of irregularly rounded, or oval, black pigment cells. The interior of the choroidea contains a clear, consistent vitreous humor; but the character of the retina I did not detect at the time. Whether a crystalline lens exists or not I am in doubt; at the time of making the investigations, in several instances I thought I discerned it very distinctly; but in other instances, even when larger species were examined, if it existed it escaped my observation.

V. CLASSIFICATION.

WITHOUT suggesting any system of classification, I have already explained (p. 47) that in the descriptive portion of this work I have grouped the genera into families according to the character of the jaw and lingual membrane. I am too well aware that such an arrangement separates genera nearly allied by other, perhaps more important, characters,[1] but the same objection may be made to any system thus far proposed.

The characters on which generic distinction is founded are more satisfactory. These are, the external form of the animal, whether slug-like, as in *Limax*, or snail-like, as in *Helix;* the position of the mantle, anterior, central, or posterior, whether naked, enclosing some form of internal shell, or protected by an external more or less developed shell; the presence or absence of longitudinal furrows above the margin of the foot, meeting over a caudal mucus pore; the presence or absence of a distinct locomotive disk to the foot; the position of the external respiratory and generative orifices; finally, by the absence or presence and character of the jaw, and the character of the lingual dentition.

When a genus is numerous in species I have, for the sake of convenience, adopted sections or subgenera, founded on special features of the shell, such as the absence or presence of internal laminæ or tooth-like processes within the aperture.

In treating the species I have recognized a wide range of variation rather than distinct specific weight in the differences one observes among numerous individuals.

Guided by these rules, I have grouped our species in the manner shown in the synopsis in Chapter VI.

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[1] Thus *Veronicella* is placed in *Holognatha,* though it widely differs from the other genera of that family in having contractile, not retractile eye-peduncles, and still more by having separate orifices for the male and female organs of generation. Again *Onchidella* from the character of its jaw is classed with *Patula,* etc., though it most widely differs from all the Geophila in having no tentacles, and though its genital system is like *Veronicella.*

VI. SYSTEMATIC INDEX.

PULMONATA GEOPHILA.

AGNATHA.

Glandina Vanuxemensis, *Lea.*
truncata, *Gmel.*
decussata, *Desh.*
Glandina bullata, *Gld.*
Texasiana, *Pfr.*

HOLOGNATHA VITRINEA.

Macrocyclis Vancouverensis, *Lea.*
sportella, *Gld.*
concava, *Say.*
Voyana, *Newc.*
Duranti, *Newc.*
Zonites *Mesomphix.*
capnodes, *W. G. B.*
fuliginosus, *Griff.*
friabilis, *W. G. B.*
caducus, *Pfr.*
lævigatus, *Pfr.*
demissus, *Binn.*
ligerus, *Say.*
intertextus, *Binn.*
subplanus, *Binn.*
inornatus, *Say.*
sculptilis, *Bland.*
Elliotti, *Redf.*
cerinoideus, *Anth.*
Hyalinia.
cellarius, *Müll.*
Whitneyi, *Newc.*
nitidus, *Müll.*
arboreus, *Say.*
viridulus, *Mke.*
indentatus, *Say.*
limatulus, *Ward.*
minusculus, *Binn.*
milium, *Morse.*
Binneyanus, *Morse.*
Zonites ferreus, *Morse.*
conspectus, *Bland.*
exiguus, *Stimpson.*
chersinellus, *Dall.*
capsella, *Gld.*
placentula, *Shuttl.*
Conulus.
fulvus, *Drap.*
Fabricii, *Beck.*
Gundlachi, *Pfr.*
Stearnsi, *Bl.*
Gastrodonta.
gularis, *Say.*
suppressus, *Say.*
lasmodon, *Phillips.*
significans, *Bland.*
internus, *Say.*
multidentatus, *Binn.*
Vitrina latissima, *Lewis.*
limpida, *Gould.*
Angelicæ, *Beck.*
Pfeifferi, *Newc.*
exilis, *Mor.*
Limax maximus, *Lin.*
flavus, *Lin.*
agrestis, *Müll.*
campestris, *Binn.*
Hewstoni, *J. G. Cooper.*
montanus, *Ing.*

HOLOGNATHA HELICEA.

*

Patula solitaria, *Say.*
strigosa, *Gld.*
Hemphilli, *Newc.*
Idahoensis, *Newc.*
Haydeni, *Gabb.*
alternata, *Say.*
Cumberlandiana, *Lea.*
perspectiva, *Say.*
Patula striatella, *Anth.*
pauper, *Mor.*
Horni, *Gabb.*
asteriscus, *Morse.*
Microphysa incrustata, *Pfr.*
vortex, *Pfr.*
Lansingi, *Bland.*
Ingersolli, *Bland.*
Hemitrochus varians, *Mke.*

Holospira Roemeri, *Pfr.*
Goldfussi, *Pfr.*
Onchidella borealis, *Dall.*
Tebennophorus Caroliniensis, *Bosc.*
Helicodiscus lineatus, *Say.*
Ferussacia subcylindrica, *L.*
Cæcilianella acicula, *Müll.*
Stenogyra *Rumina.*
decollata, *L.*
Opeas.
subula, *Pfr.*
octonoides, *Ad.*
Melaniella.
gracillima, *Pfr.*
Pupa *Pupilla.*
muscorum, *L.*
Blandi, *Morse.*
Hoppii, *Müll.*
variolosa, *Gld.*
pentodon, *Say.*
decora, *Gld.*
corpulenta, *Morse.*
Rowelli, *Newc.*
Californica, *Rowell.*
Leucochila.
fallax, *Say.*
modica, *Gld.*
Arizonensis, *Gabb.*
hordeacea, *Gabb.*
armifera, *Say.*
contracta, *Say.*
rupicola, *Say.*
corticaria, *Say.*
pellucida, *Pfr.*
borealis, *Mor.*
alticola, *Ing.*
Vertigo Gouldi, *Binn.*
Bollesiana, *Morse.*
milium, *Gld.*
ovata, *Say.*
ventricosa, *Morse.*
simplex, *Gld.*
Strophia incana, *Binn.*

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Arion fuscus, *Müll.*
foliolatus, *Gld.*
Ariolimax Columbianus, *Gld.*
Californicus, *J. G. Coop.*
niger, *J. G. Coop.*
Hemphilli.
Andersoni.
Prophysaon Hemphilli, *Bl. & Binn.*
Veronicella Floridana, *Binn.*
olivacea, *Stearns.*
Binneya notabilis, *J. G. Coop.*
Hemphillia glandulosa, *Bl. & Binn.*
Pallifera dorsalis, *Binn.*
Wetherbyi, *W. G. Binn.*
Strobila labyrinthica, *Say.*
Hubbardi, *Brown.*
Gonostoma Yatesi, *J. G. Coop.*
Polygyra auriculata, *Say.*
uvulifera, *Shuttl.*
auriformis, *Bld.*
Postelliana, *Bld.*
espiloca, *Rav.*
avara, *Say.*
ventrosula, *Pfr.*
Hindsi, *Pfr.*
Texasiana, *Moricand.*
triodontoides, *Bld.*
Mooreana, *W. G. Binn.*
hippocrepis, *Pfr.*
fastigans, *L. W. Say.*
Jacksoni, *Bld.*
Troostiana, *Lea.*
Hazardi, *Bld.*
oppilata, *Moricand.*
Dorfeuilliana, *Lea.*
Ariadnæ, *Pfr.*
septemvolva, *Say.*
cereolus, *Muhlf.*
Carpenteriana, *Bld.*
Febigeri, *Bld.*
pustula, *Fér.*
pustuloides, *Bld.*
leporina, *Gld.*
Polygyrella polygyrella, *Bld. & J. G. Coop.*
Stenotrema spinosum, *Lea.*
labrosum, *Bld.*
Edgarianum, *Lea.*
Edvardsi, *Bld.*
barbigerum, *Redf.*
stenotremum, *Fér.*
hirsutum, *Say.*
maxillatum, *Gld.*
monodon, *Rack.*
germanum, *Gld.*
Triodopsis palliata, *Say.*
obstricta, *Say.*
appressa, *Say.*
inflecta, *Say.*

Triodopsis Rugeli, *Shuttl.*
tridentata, *Say.*
Harfordiana, *J. G. Coop.*
fallax, *Say.*
introferens, *Bld.*
Hopetonensis, *Shuttl.*
Van Nostrandi, *Bld.*
vultuosa, *Gld.*
loricata, *Gld.*
Mesodon major, *Binn.*
albolabris, *Say.*
divesta, *Gld.*
multilineata, *Say.*
Pennsylvanica, *Green.*
Mitchelliana, *Lea.*
elevata, *Say.*
Clarki, *Lea.*
Christyi, *Bld.*
exoleta, *Binn.*
Wheatleyi, *Bld.*
dentifera, *Binn.*
Roëmeri, *Pfr.*
Wetherbyi, *Bld.*
thyroides, *Say.*
clausa, *Say.*
Columbiana, *Lea.*
Downieana, *Bld.*
Lawi, *Lewis.*
jejuna, *Say.*
Mobiliana, *Lea.*
devia, *Gld.*
profunda, *Say.*
Sayii, *Binn.*
Acanthinula harpa, *Say.*
Vallonia pulchella, *Müll.*
Fruticicola hispida, *L.*
rufescens, *Penn.*
Dorcasia Berlandieriana, *Mor.*
griseola, *Pfr.*
Turricula terrestris, *Chemn.*
Aglaja fidelis, *Gray.*
Aglaja infumata, *Gld.*
Hillebrandi, *Newc.*
Arionta arrosa, *Gld.*
Townsendiana, *Lea.*
tudiculata, *Binn.*
Nickliniana, *Lea.*
Ayresiana, *Newc.*
redimita, *W. G. Binn.*
intercisa, *W. G. Binn.*
Kelletti, *Fbs.*
Stearnsiana, *Gabb.*
exarata, *Pfr.*
ramentosa, *Gld.*
Californiensis, *Lea.*
Carpenteri, *Newc.*
Mormonum, *Pfr.*
sequoicola, *J. G. Coop.*
Diabloensis, *J. G. Coop.*
Traski, *Newc.*
Dupetithouarsi, *Desh.*
ruficincta, *Newc.*
Gabbi, *Newc.*
Glyptostoma Newberryanum, *W. G. Binn.*
Euparypha Tryoni, *Newc.*
Tachea hortensis, *Müll.*
Pomatia aspersa, *Müll.*

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Cylindrella Poeyana, *Pfr.*
jejuna, *Gld.*
Macroceramus Kieneri, *Pfr.*
Gossei, *Pfr.*
Bulimulus serperastrus, *Say.*
Floridanus, *Pfr.*
multilineatus, *Say.*
Dormani, *W. G. B.*
Marielinus, *Pfr.*
patriarcha, *W. G. B.*
alternatus, *Say.*
Schiedeanus, *Pfr.*
dealbatus, *Say.*

GONIOGNATHA.

Liguus fasciatus, *Müll.*
Orthalicus undatus, *Brug.*
Punctum pygmæum, *Dr.*

ELASMOGNATHA.

Succinea Haydeni, *W. G. B.*
retusa, *Lea.*
Sillimani, *Bld.*
ovalis, *Gld.*, not *Say.*
Succinea Higginsi, *Bld.*
Haleana, *Lea.*
Mooresiana, *Lea.*
Grosvenori, *Lea.*

Succinea Wilsoni, *Lea.*
Concordialis, *Gld.*
luteola, *Gld.*
lineata, *W. G. Binn.*
avara, *Say.*
Stretchiana, *Bld.*
Verrilli, *Bld.*
aurea, *Lea.*
Groenlandica, *Beck.*
Succinea obliqua, *Say.*
Totteniana, *Lea.*
campestris, *Say.*
Hawkinsi, *Bd.*
rusticana, *Gld.*
Nuttalliana, *Lea.*
Oregonensis, *Lea.*
effusa, *Shuttl.*
Salleana, *Pfr*

VII. DESCRIPTIONS OF GENERA AND SPECIES.

Order PULMONATA.

Lingual membrane varying from short and broad to long and narrow; teeth numerous, in numerous uniform transverse rows. Mouth usually with one or more horny jaws. Respiratory organ in the form of a closed chamber lined with pulmonic vessels on the back of the animal and covered by the shell when present; edge of the mantle attached, — the entrance to the air-chamber being through an opening in the side, closed by a valve. Operculum almost universally absent. Animal hermaphrodite, with reciprocal impregnation, generally oviparous, terrestrial, fluviatile or marine, but respiring free air. Tentacles and eye-peduncles retractile or contractile.

Shell varied in form, sometimes rudimentary or wanting.

Eyes at the end of elongated peduncles, or on the head of the animal.

The *Pulmonata* are usually divided into three suborders, — *Geophila*, *Limnophila*, and *Thalassophila*, — names derived respectively from the comparatively terrestrial, fluviatile, and marine habits of the animals. These suborders are readily distinguished by the position of the eyes, either sessile or on peduncles, and the characters of the tentacles.

I have included in this volume only the species of the first suborder, though one species of the *Limnophila*, *Carychium exiguum*, is truly terrestrial. It will be understood also that I do not include any gill-bearing genus, however terrestrial may be its habits. Thus I omit many genera included in Vols. II. and IV.

SUBORDER GEOPHILA.

Eyes at the tips of elongated, cylindrical peduncles; tentacles retractile or contractile, cylindrical, shorter than, and placed under, the eye-peduncles, sometimes very small or wanting. Operculum never present in the adult. Animal usually terrestrial.

I do not propose any system of classification for the *Pulmonata*, but the genera found within our limits may be grouped by the character of their jaw and lingual dentition into

A. **Agnatha.** Jaw absent; marginal teeth aculeate or quadrate.
B. **Holognatha Vitrinea.** Jaw in one piece; marginal teeth aculeate.
C. **Holognatha Helicea.** Jaw in one piece; marginal teeth quadrate.
D. **Goniognatha.** Jaw in separate pieces, the upper median one usually triangular; marginal teeth quadrate.
E. **Elasmognatha.** Jaw with an accessory upper piece; marginal teeth quadrate.

This grouping, as is the case with any founded on one or two separate characters, unites many genera otherwise widely separated, and as widely separates some quite as intimately connected by other, perhaps more important, characters. It seems to me, however, that these distinctions may be, in the present state of our knowledge, considered of family value, quite as well as those founded on the mantle, shell, or other character. The names *Testacellidæ, Vitrinidæ, Helicidæ, Orthalicidæ, Succinidæ,* have also been used for the same divisions.

A. AGNATHA.

Jaw absent; marginal teeth aculeate or quadrate.

Of this division or family we have within our limits only the genus *Glandina.* Many other and varying genera, heliciform and limaciform, have been described from other fauna.

GLANDINA, SCHUM.

Shell oblong, fusiform, horn-colored; whorls 6 – 8, the last attenuated at base. Aperture narrow, elliptically oblong; peristome simple; columella twisted forward at the base and truncated. Suture often crenulated or margined. Uniform in color, or ornamented with longitudinal, usually brownish streaks.

Animal heliciform (see Vol. III. Pl. LIX.), elongated, narrowed anteriorly; eye-peduncles long, having the eye-spots on the posterior face, behind the tips, which are deflected; tentacles half the length of the eye-peduncles, bulbous, and somewhat deflected at tip; on each side of the oral aperture is a retractile, palpiform appendage, attenuated at tip, and more or less recurved, nearly as long as the eye-peduncle, the bases separated by a fissure in front; buccal pouch capable of a proboscidiform protrusion, the aperture furnished with three papillæ above and three on each side. Genital orifice at some distance behind the right eye-peduncle. Anal and respiratory orifices on the right of the mantle, under the peristome of the shell. Mantle thin, posterior, covered by a well-developed shell. No distinct locomotive disk. No caudal mucus pore.

The eggs are eight millimeters long, covered with a hard calcareous shell.

The subgenera *Varicella* and *Oleacina*, s. str., are not found within our limits, but only the

SUBGENUS GLANDINA, s. str.

Shell ovate, or ovate-oblong, plicately striate, generally of a silken lustre, but never glittering, and usually decussated with delicate revolving lines; suture crenulated; aperture equalling about half the shell's length, its peristome simple.

Jaw absent. Lingual membrane narrow, with chevron-shaped rows of uniform, aculeate, separated teeth; central tooth with a long, slender, straight base of attachment, with incurved sides, and with inferior lateral slightly expanded angles, and with the upper margin reflected and extended into a long, slender, acutely pointed cusp. There are no lateral teeth, the balance of the membrane being composed of marginal teeth of the pure aculeate form.

Each row of teeth on either side of the median line curves first backward, with the teeth rapidly increasing in size as they pass outwards, and then forwards as the teeth gradually again become smaller; giving an irregularly crescentic shape to the half-row of teeth. This is shown particularly in *Gl. Albersi* and *G. rosea*, less so in *Gl. truncata.* The central tooth was overlooked by Wyman, Leidy, and other of the earlier investigators. It has since been detected in *Gl. truncata,*[1] *rosea,*[2] *algira,*[3] *Sowerbyana,*[4] *plicatula,*[5] *fusiformis,*[6] *Albersi*[7]; in *semitarum,*[8] *Phillipsi*[9] of the subgenus *Varicella;* also *solidula*[10] of subgenus *Oleacina.* This central tooth is rather difficult to study, being on a different plane from the other teeth, and apparently much less developed.

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[1] See L. & Fr.-W. Sh., I. Fig. 6.

[2] Amer. Journ. Conch., V. 202, Fig. 1.

[3] Fischer and Crosse, J. de C., XVI. 234, 1868; Moll. Mex. et Guat., Pl. IV. Fig. 10.

[4] Same, Moll. Mex. et Guat. 73, Pl. IV. Figs. 6–9.

[5] Ibid., p. 73.

[6] Ibid.

[7] L. & Fr.-W. Sh., I. Fig. 10, p. 19.

[8] Proc. A. N. S. Phil. 1874, 49.

[9] Ibid.

[10] Ann. Lyc. N. H. of N. Y., X. 347.

Its cusp is generally simple, long, and narrow; but in *G. rosea* it has a decided blunt cutting point, and in *G. semitarum* it has a long, slender cutting point; for that of *G. truncata*, see below.

The side teeth are all of the purely aculeate type; the base of attachment is long, narrow, incurved at sides, gradually rounded above, expanded and bluntly truncated below, the general outline being somewhat like that of the sole of a shoe. From this base of attachment springs a large aculeate cutting point. These side teeth are like the marginals in *Zonites*, *Limax*, etc.; they may therefore be called marginal teeth, and the lateral teeth, usually present in the *Vitrinea*, may be said to be entirely wanting.

As stated above, the marginal teeth increase rapidly in size for a short distance from the median line, and then gradually decrease in size, as they pass off laterally, the last tooth being still smaller than the first.

In illustrating the dentition of this genus, I refer to the figure on p. 297, Vol. II., to show the general arrangement *en chevron* of the rows of teeth. Fig. A of my Plate I. is intended to show the shape of the individual teeth of *G. truncata* from the central to the extreme marginal.

I have not had an opportunity of examining the lingual membrane of *G. bullata*, *Texasiana*, *decussata*, or *Vanuxemensis*.

The restricted subgenus is confined almost exclusively to Mexico and Central America, but several species are found in our Southern Region, even as far north as South Carolina. There is also one Mediterranean species.

Glandina Vanuxemensis, Lea.

Vol. III. Pl. LXII. Fig. 1.

Shell elongated, ovate-fusiform, thin and fragile, considerably transparent, pale fawn-color, in some specimens inclined to greenish, and generally flecked with distant, pale spots; the surface is, in a measure, coarsely granulated by the decussation of longitudinal and revolving lines, the latter of which are more distant from each other than the former, and become less and less distinct towards the anterior portion of the whorl; whorls 7 or 8, the apical ones smooth and forming a mammillary tip; suture crenulated; aperture about one half the length of the shell, nearly three times as long as broad; columella strongly arched, and scarcely glazed by enamel. Length of axis, 68 mill.; breadth, 25 mill.

Glandina Vanuxemensis, Lea, Trans. Am. Philos. Soc., V. 84, Pl. XIX. Fig. 78, Obs. I. 196 (1837). — Pfeiffer, Symbolæ, III. 91. — Binney, Terr. Moll., II. 299, Pl. LXII. Fig. 1. — W. G. Binney, T. M., IV. 141; L. & Fr.-W. Sh., I. 15. — Fischer and Crosse, Moll. Mex., 100 (1870).

Glandina Vanuxemii, Tryon, Am. Journ. Conch., II. 226 (1866).

Achatina Vanuxemensis, Reeve, Conch. Icon., Pl. XIII. Fig. 48. — Pfeiffer, Monog. Helic. Viv., II. 294.

Oleacina Vanuxemensis, Pfeiffer, Brit. Mus. Cat., 36; Mon. Hel., IV. 643.

A species of the Mexican fauna, but actually found also in the Texas Region. I have not seen any other specimen than the one figured in Vol. III.

Animal and dentition unknown.

Glandina truncata, Gmelin.

Vol. III. Pls. LIX., LX., LXI., Fig. 2; LXII., Fig. 2.

Shell strong, ovate-fusiform or ellipsoidal, obtuse at tip, of a pale ashy fawn-color, or rather alternately striped with ash-color and fawn-color, and more or less tinted rose-color, the surface shining and delicately fluted with longitudinal, raised, and rounded striæ; whorls 6 or 7, moderately convex, the last constituting three fourths the length of the shell, somewhat compressed at the middle, so as to become in a measure cylindrical, narrowing forward and rounded at base; suture strongly marked, delicately crenulate; aperture about one half the length of the shell, often more, and twice as long as broad, narrow, ovate-lunate, acute posteriorly, obtusely rounded anteriorly; peristome nearly rectilinear at its middle portion, and springing somewhat forwards; columella arched at its lower portion, and decidedly truncate at base; throat salmon-colored; edge of peristome pale. Average length, 37 mill., often very much longer, even 100 mill.; breadth somewhat more than one third the length.

Bulla truncata, Gmelin, p. 3434.

Buccinum striatum, Chemnitz, IX. 36, Tab. CXX. Fig. 1028, 29?

Bulimus striatus, Bruguière, Encycl. Méth., I. 366.

Cochlicopa rosea, Férussac, Prodrome, 356; Hist. des Moll., Pl. CXXXV. Fig. 3, Pl. CXXXVI. Figs. 6-10.

Achatina rosea, Deshayes, Encycl. Méth., II. 10 (1830); ed. Lamarck, VIII. 313.

Achatina striata, Deshayes in Lam., ed. 3, III. 381. — Chemnitz, ed. 2, Tab. III. Figs. 3, 4.

Achatina truncata, D'Orbigny, Moll. Cub., I. 163, Pl. X. Fig. 13. — Reeve, Conch. Icon., Pl. XIII. Fig. 47. — Chemnitz, l. c. (Bul.), Tab. XXXVIII. Figs. 21, 22 (Achatina), No. 78. — Pfeiffer (nec Glandina), Mon., III. 512.

Polyphemus glans, Montfort, Conch., II. 415, Fig. civ. (1810). — Say, Journ. Acad. Nat. Sci., I. 282 (1818); Nich. Enc., ed. 3 (1819); ed. Binney, 13, 7. — Férussac, Tabl. Syst., 11.

Glandina truncata, Say, Amer. Conch., II. Pl. XX. (1831); ed. Binney, p. 34, Pl. XX.; ed. Chenu (Bib. Conch.), III. 28, Pl. VII. Figs. 2, 2 a. — Pfeiffer, Mon. Helic. Viv., II. 286. — DeKay, N. Y. Moll., 56 (1843). — Mrs. Gray, Fig. Moll. An., Pl. CCCI. Fig. 5 (ex Bost. Journ.). — Binney, T. M., II. 301, Pls. LIX., LX., LXI. Fig. 2; LXII. Fig. 2. — W. G. Binney, T. M., IV. 141, Pl. LXXX. Fig. 9; L. & Fr.-W. Sh., I. 15, Fig. 5 (1869). — Leidy, T. M. U. S., I. 258, 259, Pls. XIV., XVI. (1851), anat. — Wyman, B. J. N. H., IV. 416, Pl. XXIII. (1844), anat. — Tryon, Am. Journ. Conch., II. 225 (1866). — Hogg, Tr. Roy. Microsc. Soc. n. s., XVI. Pl. XIII. Fig. 84 (dentition).

Olcacina truncata, Pfeiffer, Mon. Hel. Viv., IV. 638. — Ib., Brit. Mus. ulmonata, p. 23.

Planorbis glans, DEKAY, l. c. 56.
Glandina parallela, W. G. BINNEY, Phila. Proc. 1857, 189; T. M., IV. 140; L. & Fr.-W. Sh., I. 17. — TRYON, Am. Journ. Conch., II. 226 (1866).
Oleacina parallela, PFEIFFER, Malak. Blätt. 1859, 51.
Glandina Texasiana, part, W. G. BINNEY, T. Moll., IV. Pl. LXXVII. Fig. 21, not of PFEIFFER.

Atlantic and Gulf States from South Carolina to Texas, thus inhabiting all the Southern Region. Very common on the islands and keys along the coast.

Animal: see above, p. 81, Vol. III. Pl. LIX.

The habits of this animal are somewhat aquatic. It is found on the sea-islands of Georgia, and around the keys and everglades of Florida; and in these situations the shell often attains the length of four inches, — when found on the oyster hummocks and less humid localities, it seldom exceeds one inch in length. Mr. Say found it in the marshes immediately behind the sand-hills of the coast. It is most readily found in the centre of the clumps of coarse grass on these marshes. In young individuals the spire forms but a small proportion of the shell, but in the old it often forms one third of the length.

The animal is in part, if not altogether, carnivorous; and its powerful lingual membrane, armed with long, sharp-pointed teeth, is well adapted to its food. By its action the soft parts of its prey are rapidly rasped away, or are forced in large morsels down the œsophagus. The animal has been seen to swallow entire the half-putrid remains of a *Helix*, and to attack *Limaces* confined in the same box with it, rasping off large portions of the integument, and in some instances destroying them. In one instance an individual attacked and devoured one of its own species, thrusting its long neck into the interior of the shell, and removing all the viscera. I found many specimens of *Polygyra volvoxis* in the stomach of individuals collected by me at St. Augustine, Fla.

The testicle is an oval mass, separated from the liver as in the *Limaces*. The epididymis appears from a hilum in the side of the testacle; at first but slightly tortuous, it becomes convoluted just before ending. Its accessory gland is large. The penis sac is long, large, and clavate, very gradually enlarging from the base to the summit. The vas deferens, which joins the latter point, is long, moderately tortuous, and wide. The retractor muscle is inserted into it near its termination in the penis sac. The bladder is oval, constricted; its duct is as long as the oviduct. The vagina is moderately broad. The cloaca is short. The exterior generative orifice is on the right side of the head, considerably posterior to the tentacles. (See Vol. I. Pls. XIV., XVI.)

Jaw absent. Lingual dentition as described above. There are about 34—1—34 teeth in each row. I have shown in Pl. I. Fig. A, the central and various marginals from the first to the last tooth. The figures show the teeth as seen from below, thus giving a perfect view of the bases of attachment. The eighth tooth seems to be the largest, in another the sixth. The central tooth I find great difficulty in studying. It appears to have a long, slender base of attachment, truncated and emarginate above and below, with slightly expanded lateral angles. The sides are somewhat incurved, giving the tooth the appearance of a simple modification of the base of attachment of the marginals. There is a single median cusp with obsolete side cusps, and a long pointed median cutting point. (See the enlarged figure.) There are no lateral teeth. The marginal teeth are all of purely aculeate type.

The shell is a very variable one, as shown by the figures in Vols. III. and IV. The form from Key West, figured in Pl. LXI. Fig. 2, is a well-marked variety, but surely is not a variety of *G. Texasiana*, as I formerly supposed it might be. After further opportunities of judging by the study of more numerous specimens, I am led to change my opinion as to the specific distinction of the form I formerly called *G. parallela*. (See outline figure of Pl. LXII.)

The rose-color of the living shell soon fades.

Glandina decussata, Deshayes.

Vol. III. Pl. LXI. Fig. 1.

Shell oblong-conic, thin, shining, horn-color; whorls 7 to 8, longitudinally striate, and covered with numerous minute revolving lines; suture slightly crenulated; aperture oblong, half as long as the shell; columella curved, truncated, covered with light callus. Length, 50 mill.; diameter, 18 mill.

Achatina decussata, Deshayes in Fér. Hist. 182, Pl. CXXIII. Fig. 34; Pl. CXXIV. Figs. 33–35 (1850). (*Vide* Pfeiffer, Mon., IV. 644).
Glandina truncata, var., Binney, T. M., II. 302, Pl. LXI. Fig. 1.
Glandina corneola, W. G. Binney, Proc. Phila. Acad. 1857, 189; T. M., IV. 139.
Glandina decussata, Tryon, Am. Journ. Conch., II. 227 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 18 (1869). — Fischer and Crosse, Moll. Mex., 112 (1870).
Olcacina corneola, Pfeiffer, Mal. Blätt. 1859, 51.

A Mexican and Guatemalan species, also found in the Texas Region at Devil's River and on the banks of the Nueces River. It is very rare in collections.

Animal, dentition, and genitalia unknown.

Glandina bullata, Gould.

Vol. III. Pl. LXII. *a*.

Shell elongate ovate, ventricose, widest a little behind the middle, very light and thin, and so translucent as to show the whole of the pillar by transmitted light, very pale horn-color, tinged with rusty brown towards the aperture, shining, and marked longitudinally with fine rounded striæ; whorls 5, tumid, the last composing about seven eighths of the shell; suture delicate, not strongly impressed; aperture two thirds the length of the shell, narrow-lunate, somewhat dilated by the moderate arching of the pillar margin, the lower third of which takes the direction of the axis; pillar margin covered by a delicate lamina of white callus. Length of axis, 37 mill.; breadth, 20 mill.

Glandina bullata, Gould, Pr. Bost. S. N. H., III. 64 (1848); T. M., II. 298, Pl. LXII. a. — W. G. Binney, T. M., IV. 139. — Tryon, Am. Journ. Conch., II. 226 (1866). — W. G. Binney. L. & Fr.-W. Sh., I. 19 (1869).
Achatina bullata, Pfeiffer, Mon. Hel., III. 512.
Oleacina bullata, Pfeiffer, Brit. Mus. Cat., 24.

Near New Orleans, and in St. Laundry Parish, Louisiana; a species of the Southern Region.

Animal unknown.

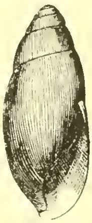
Probably a variety of *G. truncata*.

Glandina Texasiana, Pfeiffer.

Shell oblong, rather solid, with crowded longitudinal striæ, shining pellucid, flesh-colored; spire convex-conic, obtuse; suture pale, minutely denticulated; whorls rather convex, the last rather longer than the spire, somewhat attenuated at the base; columella quite arched, forming at its base a white, twisted, abruptly truncated lamina; aperture scarcely oblique, acutely oval; peristome simple, obtuse. Length 29, diameter $10\frac{1}{2}$ mill.; length of aperture 16, breadth $5\frac{1}{2}$ mill.

Achatina Texasiana, Pfeiffer, Novit. Conch., VIII. p. 82, Pl. XXII. Figs. 11, 12 (1857); Proc. Zoöl. Soc. 1856.
Glandina Texasiana, W. G. Binney, T. M., IV. 140. — Tryon, Am. Journ. Conch., II. 226, excl. Fig. (1866).
Oleacina Texasiana, Pfeiffer, Mon. Hel., IV. 641.

Fig. 9.



Glandina Texasiana.

Texas Region. I have specimens from Brownsville.

Fig. 9 is a fac-simile of one of Pfeiffer's figures.

Formerly I erroneously referred to this species the small form of *Gl. truncata*, figured in Vol. III. Pl. LXI. Fig. 2.

Animal not examined.

SPURIOUS SPECIES OF GLANDINA.

G. Marminii, Deshayes, is referred doubtfully to North America in Beck's Index, 75.

SPURIOUS AND EXTRALIMITAL SPECIES OF AGNATHA.

Testacella ——. (Hitchcock's Geol. Rep. Mass. 1835, 27.) It is impossible to say what is referred to; certainly not a *Testacella*, as that genus is not found native to North America.

Testacella haliotoidea. A single specimen found in a greenhouse in Nova Scotia. Probably imported on plants.

B. **HOLOGNATHA VITRINEA.**

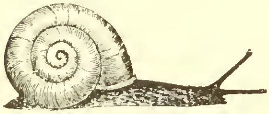
Jaw in one piece. Marginal teeth aculeate.

There are numerous genera of this subfamily in other fauna, but within our limits we find only the following: *Macrocyclis*, *Zonites*, *Limax*, and *Vitrina*

Macrocyclis, Beck.

Animal heliciform; mantle posterior, covered with a shell; eye-peduncles long, slender; foot narrow, twice as long as the diameter of the shell, tail pointed, scarcely reaching behind the shell; respiratory and anal orifices on the right of the mantle, under the peristome of the shell; generative orifice behind the right eye-peduncle; no distinct locomotive disk or caudal mucus pore. Carnivorous.

Fig. 10.



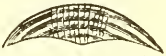
Animal of *Macrocyclis concava.*

Shell thin, widely umbilicated, depressed, striate or wrinkled, color uniform; whorls $4\frac{1}{2}-5$, the last broad, depressed, moderately deflexed in front; aperture obliquely ovate; peristome somewhat thickened or expanded, the margins approximating, the basal shortly reflexed.

A few species of this genus have been found in Chili and the West Indies. It seems, however, to reach its greatest development in our Pacific Province.

Jaw crescentic, ends sharply pointed, anterior surface striated; cutting margin smooth, with a median projection. I have examined the jaw of *M. Vancouverensis* (Fig. 11), *sportella, concava, Duranti, Voyana,* and in the West Indian species, *M. Baudoni,*[1] Petit, and *M. euspira,* Pfr.[2]

Fig. 11.



Jaw of *Macrocyclis Vancouverensis.*

The general arrangement of the lingual membrane of *Macrocyclis* is the same as I have described above for *Glandina.*

There are 32 rows in one lingual examined of *M. Vancouverensis.* The rows of teeth are arranged *en chevron.* Each row is divided by the median line into two irregular crescents, the teeth rapidly increasing and curving in a backward direction, and then gradually decreasing in size and curving forward. (See my figures on Pl. I.) In *M. Vancouverensis* the sixth tooth is the largest. The teeth of *Macrocyclis,* as also of *Glandina,* are separated, not crowded, as in the *Helicea.* The central tooth is seen with some difficulty by the microscope. I am confident, however, that I have drawn it correctly for the various species. In *M. Vancouverensis* (Pl. I. Fig. B) the base of attachment is small, triangular, the apex pointed forward, the angles bluntly rounded, somewhat incurved at base, and bears a delicate, simple, short, slender cutting point, reaching from about its centre to near its base. This cutting point was not figured by Morse, and, indeed, was observed by me only on a few of the central teeth, and then with difficulty. In *M. concava* (Pl. I. Fig. C) the central tooth has a larger base of attachment, the apex of the triangle is truncated and incurved, the base is more incurved, the outer lower corners more expanded and pointed, the cutting point more developed, with distinct lateral expansions like very slightly developed subobsolete side cusps. In *M. Voyana* (Pl. I. Fig. D) the central tooth has a long, narrow, quadrangular base of attachment, incurved above, below, and at sides, and bears near its base three small, sharp cutting points, the median the largest; there seem to be no distinctly developed cusps bearing these cutting points. In *M. Duranti* (Pl. I. Fig. E) the central tooth has a base of attachment somewhat like that of *M. Vancouverensis*, but longer, and with incurving sides; the cutting point is the same. I have also examined the lingual membrane of *M. sportella* (Pl. XV. Fig. K), which may be merely a variety of *Vancouverensis;* its dentition is quite the same. The other species mentioned above are readily distinguished one from another by the form of their central teeth.

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[1] See Am. Journ. Conch., VII. 175; Ann. Nat. Hist. N. Y., X. 305.

[2] See Proc. Ac. Nat. Sci. Phila. 1875, 247, Pl. XXI. Fig. 3.

The side teeth of *Macrocyclis* at first sight, especially when seen from below, appear to be of the purely aculeate type, as the marginals in *Zonites* and *Limax.* From this, one is inclined to consider them all as marginals, and to declare that no true lateral teeth exist, thus making *Macrocyclis* to agree with *Glandina* in this particular also. A more careful study shows us that the teeth nearest the median line are modified from the aculeate type, though they do not have the distinct form of the laterals of *Zonites*, with decided cusps and cutting points. They seem rather to represent those teeth of *Zonites* which show the transition from the laterals to the marginals (see Pl. II. Fig. F, the second lateral tooth of *Z. lævigatus*). It may be said, therefore, that the lateral teeth are entirely wanting in *Macrocyclis*, the first side teeth being laterals in the transition state, the balance being pure marginals. (See, however, *M. euspira*, Pr. Ac. Nat. Sc. Phila. 1875, Pl. XXI. Fig. 3, which has a lingual membrane of *Glandina*.) The base of attachment of these transition teeth is like those of the marginals, i. e. sole-like, except that the lower lateral expansions are more developed and angular, and in *concava* and *Voyana* the lower edge is excurved rather than incurved. The cusps are long and slender, lengthened into cutting points; the teeth are asymmetrical by the greater development of the outer subobsolete side cusps, both of these cusps being distinctly indicated by expansion. In *M. Vancouverensis* there is apparently a small sharp side point on the inner side of the cusp. I am not certain of its character, and have not ventured to figure it, excepting on the second tooth in Fig. B of Pl. I. This process is seen on the first six teeth only. The balance of the teeth beyond the transition teeth in all the species are marginals of the pure aculeate type. They vary in sharpness in different parts of the same membrane, as will be seen by comparing my Fig. b of Pl. I. Fig. C with the other marginals figured. In *M. Duranti* the extreme marginals are large in comparison with those of the other species.

In studying my figures of the lateral teeth, it must be remembered that Figs. C and D are drawn as seen from above, to show the form of the cusp. The other figures are drawn from below, to show the base of attachment.

M. Vancouverensis, drawn by Morse, has 22—1—22 teeth, two other membranes examined by me gave 24—1—24, one other 18—1—18. *M. concava* has given 20—1—20, 23—1—23, and 25—1—25. Of *M. Duranti* I have counted but one membrane having 18—1—18. A single membrane of *M. Voyana* had 24—1—24 teeth. *M. sportella* has 22—1—22.

To sum up the characters of the dentition of *Macrocyclis*, it may be said to be intermediate between *Glandina* and *Zonites*, differing from the former in the presence of the transition teeth from true laterals to true marginals, differing, however, from the latter by the absence of true lateral teeth.

Macrocyclis Vancouverensis, Lea.

Vol. III. Pl. XX.

Shell widely umbilicated, depressed, very slightly convex on the upper surface; epidermis light greenish-yellow; whorls 5, nearly flat above, protuberant and rounded on the lower surface, lines of growth very minute, with crowded, microscopic revolving striæ, the outer whorl expanding a little towards the aperture; umbilicus wide and deep; aperture transverse, somewhat rounded, flattened above by a depression of the peristome near its junction with the body-whorl, its edge tinged with rufous; peristome thin, acute, slightly reflected at the base of the shell, simple above, the two extremities approaching each other, and connected by a thin callus, which covers the columella. Greater diameter 31, lesser 26 mill.; height, 14 mill.

Helix concava, Binney, Bost. Journ. Nat. Hist., III. 372, Pl. XIV. (1840), not of Say.

Helix Vancouverensis, Lea, Am. Phil. Trans., VI. 87, Pl. XXIII. Fig. 72; Obs., II. 87 (1839). — Troschel, Arch. fur Nat. 1839, II. 21. — DeKay, N. Y. Moll., 45 (1843). — Pfeiffer, Symbolæ, II. 41; Mon. Hel. Viv., I. 200; in Chemnitz, ed. 2, II. 146, Pl. XCIV. Figs. 21-23. — Binney, Terr. Moll., II. 166, Pl. XX. — W. G. Binney, Terr. Moll., IV. 19. — Gould, U. S. Expl. Ex., 36, Fig. 37 (1852). — Reeve, Con. Icon., No. 669 (1852).

Helix vellicata, Forbes, Proc. Zoöl. Soc. Lond. Mar. 1850, 75, Pl. IX. Fig. 1. — Chemnitz, ed. 2, II. 454, Pl. CLIV. Figs. 42-44. — Reeve, Con. Icon., No. 673 (1852). — Pfeiffer, Mon. Hel. Viv., III. 155.

Macrocyclis Vancouverensis, Tryon, Am. Journ. Conch., II. 245 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 54 (1869).

A species of the Pacific Province ranging from lat. 60°, in Alaska, to lat. 37°; above lat. 49° it passes the Cascade Mountains, and ranges southeasterly into Idaho and Montana.[1] In these latter localities the species is reduced in size. It reaches its greatest development in the region of Astoria.

Animal short posteriorly, sub-cylindrical, very light-colored, giving a straw-colored reflection, sides pearly, marked with longitudinal lines of coarse, elongated, squamose granules, about eight or ten on each side.

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[1] A most interesting paper on the distribution of the West Coast species, by Dr. J. G. Cooper, will be found in Vol. IV. of Amer. Journ. of Conch.

The species is very nearly allied to *M. concava.* The differences observable are the following: The size of this shell greatly exceeds the latter in all its proportions, its transverse diameter being nearly twice as great. This difference is not caused by an increased number of whorls, for the number in both is precisely the same; but this shell seems to be projected originally upon a larger scale, the nucleus being as much larger as mature specimens. The color is much more yellow. The umbilicus is not so widely expanded, and does not admit of counting all the whorls; and the whorls seem to be more voluminous. The striæ of growth are usually coarser, and the microscopic revolving striæ are stronger and much more constantly present.

It also strongly resembles *M. sportella,* but in that species the revolving lines usually cut merely the summits of the radiating striæ, without being continuous over the whole surface.

Jaw crescentic, ends sharply pointed; anterior surface ridged; concave margin smooth, with a median projection. (See p. 88, Fig. 11.)

Lingual membrane (Pl. I. Fig. B): see p. 89.

The genitalia are figured on Pl. XII. Fig. L. The epididymis is extremely long and very large, forming the peculiar feature of the system. The genital bladder is oval, with a long duct, which is very much broader at the end nearer the vagina. The penis sac is long, gradually tapering at its apex, where it receives the vas deferens. Upon the side of the vagina, about the middle of its length, is a wart-like protuberance, which may be a dart sac or a vaginal prostate (*d s*).

A comparison of Dr. Leidy's figure of the genitalia of *M. concava* in Vol. I., shows considerable difference between the two species, especially in the epididymis.

Macrocyclis sportella, Gould.

Vol. III. Pl. XXII. *a*, Fig. 1.

Shell much depressed, convex above, concave beneath, sloping into a broad, tunnel-shaped umbilicus; surface delicate and shining, of a pale, yellowish-green color, regularly sculptured with sharp, coarse striæ of growth, which are crossed by fine, crowded, revolving lines, which usually cut merely the summits of the radiating ridges, so that, to the naked eye, the surface appears but minutely granulated, but under a magnifier the raised spaces are seen to be well-defined squares; whorls 5, separated by a deep suture, the outer one proportionally large: aperture nearly circular, a little angular at base, modified by the preceding whorl; peristome acute, simple. Greater diameter, 12 mill.; height, 6 mill.

Helix sportella, Gould, Proc. Bost. Soc. Nat. Hist., II. 167 (1846); Moll. Ex. Ex., 37, Fig. 42 (1852); T. M., II. 211, Pl. XXII. a, Fig. 1. — W. G. Binney, Terr. Moll., IV. 19. — Pfeiffer, Mon. Hel. Viv., I. 111. V. 246 (1868). — Bland, Ann. N. Y. Lyc., VII. 366; VIII. 165.

Macrocyclis sportella, TRYON, Am. Journ. Conch., II. 245 (1866). — W. G. BINNEY, L. & Fr.-W. Sh., I. 57 (1869).

From San Diego to Puget Sound; confined to the Pacific Province.

See remarks under *M. Vancouverensis.*

In extreme forms of this species the revolving lines mark the whole surface, even in the umbilicus and in the interstices between the incremental striæ.

Jaw and lingual membrane as usual in the genus, the latter resembling that of *M. Vancouverensis*. Teeth 22—1—22. Pl. XV. Fig. K.

Macrocyclis concava, SAY.

Vol. III. Pl. XXI.

Shell depressed, very slightly convex on the upper surface; epidermis whitish horn-color, sometimes with a tinge of green; whorls 5, above flattened, below rounded, finely striate obliquely, and sometimes with microscopic revolving lines; the outer whorl spreading a little towards the aperture; suture rather deeply impressed; umbilicus wide, deep, exhibiting all the volutions to the apex; aperture rounded, somewhat flattened above, its edge frequently tinged with reddish-brown; peristome sub-reflected at its columellar extremity, simple above, and in some specimens considerably depressed near its junction with the outer whorl; columella with a thin callus, the edge of which connects the upper and lower extremities of the peristome. Greater diameter 21, lesser 16 mill.; height, 7 mill.

Helix concava, SAY, Journ. Acad., II. 159 (1821); BINNEY'S ed., 20. — BINNEY, Bost. Journ. Nat. Hist., III. 372 (1840), excl. pl.; Terr. Moll., II. 163, Pl. XXI. — ADAMS, Vermont Mollusca, 159 (1842), excl. syn. *Vancouverensis.* — DEKAY, N. Y. Moll., 33, Pl. II. Fig. 15 (1843). — PFEIFFER, Mon. Hel. Viv., IV. 159. — W. G. BINNEY, Terr. Moll., IV. 63. — LEIDY, T. M. U. S., I. 258, Pl. XII. Figs. 9-11 (1851), anat. — MORSE, Amer. Nat., I. 412, Figs. 26, 27 (1867).

Helix planorboides, FÉRUSSAC, Hist. Nat. des Moll., Tab. LXXXII. Fig. 4. — PFEIFFER, Mon. Hel. Viv., I. 200; Symbolæ, II. 37. — CHEMNITZ, ed. 2, II. 164, Pl. XCV. Figs. 17-19; Pl. CLIV. Fig. 45 (1851). — REEVE, Con. Icon., 674 (1852). — DESHAYES in FÉR. I. 87.

Helix dissidens, DESHAYES in FÉR. Hist., I. 97, Pl. LXXXIV, Figs. 1, 2.

Macrocyclis concava, MORSE, Journ. Portl. Soc., I. 12, Pl. V. Fig. (1864). — TRYON, Am. Journ. Conch., II. 245 (1866). — W. G. BINNEY, L. & Fr.-W. Sh., I. 56 (1869). — GOULD and BINNEY, Inv. of Mass., ed. 2. p. 406 (1870).

A Post-pleiocene species still existing in full vigor in the Eastern Province. Ranges from Canada to Georgia, from Michigan to Missouri. The finest specimens occur in the southern part of the Appalachian chain.

Animal: upper surface grayish, tentacles and eye-peduncles bluish, base dirty-white, collar reddish-orange, posterior extremity slightly tinged with the same. Eye-peduncles slender, foot narrow, twice as long as the diameter of the shell. (See p. 88, Fig. 10.)

This shell, though frequently seen, does not seem to be so numerous in our forests as some other species. It is peculiar for the elegant, rounded shape of the whorls, as seen on their lower surface. It rarely varies from the common type, and cannot be mistaken for any other Eastern species. The animal is voracious in its appetite, almost always preying upon other species with which it may be kept, and so certainly destroying them that I have been obliged to keep them by themselves. This it effects by inserting its narrow body, which it has the power of elongating and protruding very far from its own shell, into the shells of its victims, and then feeding upon them at its leisure. It burrows in the soil under decaying logs.

See remarks under *M. Vancouverensis.*

Jaw crescentic, ends bluntly rounded; anterior surface striated; concave margin smooth, with a median projection. (See Vol. I. Pl. XII. Fig. XI.)

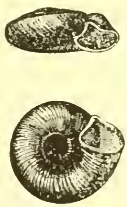
Lingual dentition (Pl. I. Fig. C): see above, p. 89, 90.

Genitalia figured by Leidy in Vol. I. Pl. XII. Figs. 9-11. The general arrangement is the same as in *M. Vancouverensis*, but the epididymis is less developed.

Macrocyclis Voyana, Newcomb.

Shell widely umbilicated, depressed, planorboid, thin, translucent, with delicate oblique striæ of growth, and fine revolving lines, more developed below, very light horn-color; spire scarcely elevated; whorls 5, flattened, rapidly increasing, the last broad, flattened below, falling in front; umbilicus very large; aperture very oblique, removed from the axis, irregular truncatedly ovate; peristome thickened, subreflected, flexuose, strongly depressed above and sinuate, ends approaching, connected with a stout, elevated, brownish, ridge-like callus. Greater diameter 21, lesser 18 mill.; height, 4 mill.

Fig. 12.



Macrocyclis Voyana.
Mag. twice.

Helix (*Macrocyclis*) *Voyana*, Newcomb, Am. Journ. Conch., I. Part III. 235, Pl. XXV. Fig. 4 (July, 1865).

Helix Voyana, Pfeiffer, Mon., V. 247 (1868).

Macrocyclis Voyana, Tryon, Am. Journ. Conch., II. 246 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 58, Fig. 98 (1869).

Canyon Creek, Trinity Co., California, and San Diego are the only localities from which it has thus far been received. It may be said, therefore, to inhabit the whole of the California Region.

The specimen figured was received from Dr. Newcomb.

Jaw as in *Vancouverensis.*

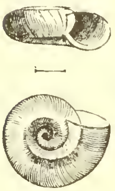
Lingual membrane (Pl. I. Fig. D): see ante, pp. 89, 90.

Genitalia not observed, but the species is *viviparous.*

Macrocyclis Duranti, Newcomb.

Shell widely umbilicated, depressed, discoidal, of a dead white or greenish color, thin, with very coarse, rough striæ; whorls 4, flattened, the last discoidal, not descending at the aperture, below broadly excavated and channelled; suture delicate; aperture removed from the axis, transversely rounded; peristome simple, acute, its terminations approaching, joined by callus, that of the columella not reflected. Greater diameter, 4 mill.; height, $1\frac{1}{3}$ mill.

Fig. 13.



M. Duranti, enlarged.

Helix Duranti, Newcomb, Proc. Cal. Acad. Nat. Sci., III. 118 (1864). — Pfeiffer, Mon., V. 171 (1863).

Patula Duranti, Tryon, Am. Journ. Conch., II. 263, Pl. IV. Fig. 53 (1866).

Hyalina Duranti, W. G. Binney, L. & Fr.-W. Sh., I. 37, Fig. 49 (1869).

A Californian Region species, extending also into the Lower California region as far south as the mouth of the San Tomas River. I have received it from Santa Barbara Island, Catalina Island (Hemphill), and from near San Francisco.

Jaw as usual in the genus. Lingual membrane (Pl. I. Fig. E): see pp. 89, 90.

Spurious Species.

Macrocyclis Elliotti, Tryon (Am. Journ. Conch., II. 246) is a true species of *Zonites*, characterized by caudal mucus pore, parallel longitudinal furrows above the margin of the foot, and the presence of perfect lateral teeth.

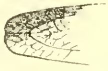
Zonites, Montf.

Animal heliciform; mantle subcentral, protected by an external shell. Respiratory and anal orifice on the right of the mantle under the peristome of the shell. Orifice of generation under the mantle. A distinct locomotive disk to foot. Two parallel well-marked longitudinal furrows above the margin of the foot, meeting at the extremity above a longitudinal caudal mucus pore.

Shell broadly umbilicated, orbiculate, convex or discoidal, striated or decussated, beneath smooth and shining; whorls 6 or 7, gradually increasing in size; aperture oblique and lunate; peristome straight, acute, and slightly thickened internally.

Formerly I separated the American species into two genera, *Zonites* and *Hyalina*, respectively characterized by the presence or absence of a distinct locomotive disk to the foot, and well-marked furrows running above and parallel to the edge of the foot, meeting above the extremity of the tail over a distinct caudal mucus pore (Fig. 14). I now place them all in *Zonites*, as all I have examined (*Z. fuliginosus*, *capnodes*, *inornatus*, *lævigatus*, *demissus*, *sculptilis*, *ligerus*, *intertextus*, *gularis*, *suppressus*, *cerinoideus*, *cellarius*, *placentula*,

Fig. 14.



Tail of *Zonites suppressus*, enlarged.

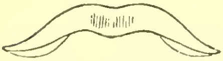
lasmodon, multidentata, viridulus, indentatus, fulvus, nitidus, limatulus) are so characterized, and I believe all will prove to be so.

The nature of the pore is described under *Z. fuliginosus.*

The external orifice of the generative organs in the species I have examined is quite under the mantle, not on the right side of the head, as inadvertently stated on p. 29 of "Land and Fresh-Water Shells," I.

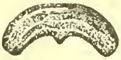
The distribution of the genus is world-wide.

Fig. 15.



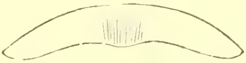
Jaw of *Z. arboreus* (Morse).

Fig. 16.



Jaw of *Z. fuliginosus.*

Fig. 17.



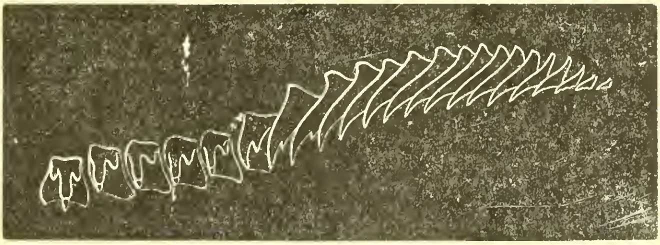
Jaw of *Z. indentatus* (Morse).

The jaw of *Zonites* is arcuate, ends acuminated, often recurved, sometimes blunt; anterior surface without ribs; cutting margin with a beak-like projection.

I have examined the jaws of almost all of our species. There is considerable variation in their form, but the general characters are constant. Sometimes there is a vertical median carina, as in *Z. minusculus.* Some species have vertical striæ, especially on the middle of the jaw (Fig. 15). Some have strong transverse lines of reinforcement (Fig. 16). In several species, such as *Z. viridulus* and *Z. Binneyanus*, Morse has detected projecting points on the cutting edge of the side of the median beak, but I did not find them in a specimen of the last species examined by me. The jaw of this last species is very high. That of *Z. exiguus* is very low. The median vertical grooves in some species are mentioned below (*Z. ferreus*).

In the preceding genus *Glandina* we found only the aculeate form of teeth or pure marginals; in *Macrocyclis* we found, in addition to these marginals, a few teeth showing a modification of this type, being the transition teeth from marginals into laterals. In the present genus, *Zonites*, we find for the first time the lateral teeth in their full development. Thus we have usually the three forms of teeth — centrals, laterals, and marginals — all present, and apparently a generic characteristic. It will be noticed, however, that in *lævigatus*[1]

Fig. 18.



General View of Dentition of *Zonites arboreus.*

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[1] See also *Z. cellarius.*

(Pl. II. Fig. F) there is no perfect lateral, the first tooth showing a decided modification or transition into the marginals. Thus we cannot say that in all species of *Zonites* there are pure lateral teeth. It will be seen below that in some species the number of laterals is reduced to two.

I give in Fig. 18 a general view of the arrangement of the teeth in *Zonites*.[1] The centrals have a base of attachment longer than wide, subquadrate, with lateral expansions at the corners of the lower margin. The reflected portion varies in size in the various species, from highly developed in *viridulus* and others, to slightly developed in *lasmodon* and others; in the latter case resembling the short reflection of *Vitrina*. The reflection always bears a more or less developed central cusp, generally reaching to or beyond the lower margin of the base of attachment, and always bearing a distinct cutting point, which last, like the cusp, is usually slender, and projects over the tooth of the adjoining transverse line. The side cusps of the reflected portion of the tooth are usually subobsolete, but they are distinctly developed in *Z. lasmodon, suppressus, Gundlachi, placentula, gularis, arboreus, cellarius, lævigatus, significans, ferreus, viridulus, nitidus, fulvus, milium.* On the side cusps are distinctly developed cutting points in all the species I have examined, excepting *lævigatus* and *cellarius*, in which I find no trace of cutting points. These points when present vary in development in the various species, generally disposed to be triangular and somewhat aculeate in form, thus bearing a resemblance to the cutting point of the marginal teeth. The greatest development of these cutting points is seen in *Z. capnodes* (Pl. II. Fig. K). The general outline of the central tooth is graceful and slender as compared with the other genera, except *Limax* and *Vitrina.* In most of my figures of the teeth of this as well as the other genera, I have given only the size of the cutting point at its lowest plane, i. e. nearest to the base of attachment. It will be understood that from hence the cutting point bulges outward as it rises upwards, and again becomes smaller as it arches above. At its widest development its outline is prominent under the microscope, as in the shaded portion of the cutting point in Pl. II. Fig. H, the dotted line showing at the same time the outline at its lowest plane.

The lateral teeth in *Zonites* are of the same type as the central, but are rendered asymmetrical (as usual in the land shells) by the suppression of the inner, lower, lateral expansion of the base of attachment and the inner side cusp and cutting point. It is only in *Z. Gundlachi* (Pl. II. Fig. D) that I have observed the inner side cutting point, and in this species, even, the lateral teeth are still sufficiently asymmetrical to be readily distinguished from the centrals; in *Z. Binneyanus* there is also a kind of inner cutting point. As mentioned above, the number of these lateral teeth varies in the respective species, and is so nearly constant as to be, I believe, a good specific character.

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[1] The characters of the separate teeth of this species are better shown in Pl. III. Fig. F.

I find, however, some difficulty in deciding in all cases where the true laterals end and the transition teeth commence, so gradual is the change in some species. Of two linguals of *Z. intertextus* examined, I found one to have 12, the other 14, perfect laterals. The number of lateral teeth in the different species is given below.

The teeth forming the gradual change from laterals to marginals are best illustrated in the case of *Z. lævigatus* (Pl. II. Fig. F), the first four side teeth being transition teeth. As already stated above, this species wants entirely the perfect laterals. In *Z. cellarius* (Pl. II. Fig. G) the two transition teeth have an inner lateral spur near the top of the cusp. The only lateral of this species has also peculiarities in its form easily seen in the figure, but difficult of description. *Z. inornatus* (Pl. II. Fig. H) has peculiar transition teeth.

The marginal teeth of *Zonites* are quite like those of *Glandina* and *Macrocyclis* (see above). The curve of the transverse rows, the rapid increase and gradual decrease in size as they pass off laterally, is shown in Pl. II. Figs. F, G, H, and in the woodcut on p. 95. The number of marginal teeth in each species examined is given below; it must be borne in mind, however, that the number is not constant in any given species, though the range of variation in number seems limited in the respective species. Thus, though I have found a slight difference in the count of teeth in several individuals of *Z. inornatus*, I have every reason to believe I shall never find it to have as many teeth as in *Z. fuliginosus.* It appears, therefore, that the count of teeth has a decided specific value, at least in most cases.

The rapid increase and subsequent gradual decrease in size of the teeth as they pass off laterally, though it appears usually a generic character, is somewhat modified in some species. Thus in one lingual membrane of *Z. intertextus* examined, I find a much more gradual increase and decrease from the first to the last marginal tooth.

The marginal teeth in *Zonites*, and, indeed, all the *Vitrinea*, are more separated than in the *Helicea*, and the separate rows are more widely removed the one from the other, especially near the outer margin of the membrane.

Though the simple aculeate form of marginals seems a generic character in *Zonites*, we find the marginals bifid in *Z. fulvus* (Pl. II. Fig. E), and bifid or even trifid in *Z. Gundlachi* (Pl. II. Fig. D), also for the first four marginals in *milium.* This character reminds us of *Vitrina* (see below); *Vitrinoconus* (Semper, Phil. Archip., 91); *Vitrinoidea* (Ibid., p. 85); *Vitrinopsis* (Ibid., p. 86), and the numerous genera of disintegrated *Nanina;* also some species of *Limax.* The first marginals of *Z. exiguus* have a side spur.

Taking the general characters of dentition into consideration, *Zonites* is nearest allied to *Limax* among our genera, but in the latter the marginals are generally more slender or spine-like, and have a less sole-like base of attachment.

The genus *Zonites* being very numerous in species, it will be convenient to group the species in several subgenera, founded on the form of the shell.

Subgenus MESOMPHIX, Raf.

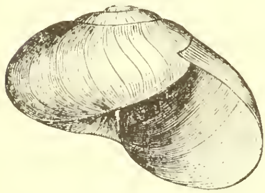
Shell umbilicated or perforated, globosely depressed, thin, striated, reddish horn-color, lighter below, shining; whorls 4½ – 6; aperture lunar-ovate; peristome simple, straight, acute, extremities approaching, that of the columella subreflexed.

Animal (of *Z. fuliginosus*) nearly twice as long as the diameter of the shell, blackish, or bluish-black, darkest on the head, neck, and eye-peduncles. Eye-peduncles short in proportion to the length of the animal, and set widely apart. Respiratory foramen in the angle formed by the junction of the peristome with the body-whorl. Base of foot whitish, the locomotive band defined by two very fine lines, or furrows. A double marginal furrow runs along the side of the foot, from the head nearly to the posterior extremity, where it passes upward, and joins that from the opposite side, leaving posteriorly a flattened, rounded extremity, somewhat prominent and glandular. Upon the centre of the extremity is a longitudinal fissure, or sinus, which is sometimes expanded, and at other times closed and invisible. Secretion of mucus from the extremity profuse.

Zonites capnodes, W. G. Binn.

Shell depressed, horn-colored or smoky, globose, wrinkled, below smooth; spire short, depressed; suture moderate; whorls 5, rapidly increasing, the last very ventricose and large, sometimes marked with coarse revolving lines; aperture large, round; peristome simple, acute, ends approached, joined by a slight deposition of brownish callus over the parietal wall, reflected at the small and deep umbilicus. Greater diameter 35, lesser 28 mill.; height, 13 mill.

Fig. 19.



Zonites capnodes.

Helix kopnodes, W. G. Binney, Proc. Acad. Nat. Sci. Philad. 1857, 186; Terr. Moll., IV. 104, Pl. LXXX. Fig. 14. — Pfeiffer, Mon. Hel. Viv., IV. 346.

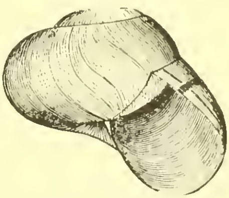
Hyalina kopnodes, Tryon, Am. Journ. Conch., II. 248 (1866).

Zonites kopnodes, W. G. Binney, L. & Fr.-W. Sh., I. 284 (1869) excl. Fig. 508 (= *laevigatus*).

It may be said to belong to the Cumberland Subregion, though it has spread into the adjoining subregion. I have actually received it from Uniontown, Perry Co., Ala., where it occurs also apparently subfossil, from Dallas Co., Ala., Stephenson, Ala., and Sewannee, Franklin Co., Tenn. From Marengo Co., Tenn., also subfossil.

Animal dirty white, the granules sometimes marked by a darker color, running into a light fawn-color on the top of the back near the head; eye-peduncles and tentacles darker; upper part of tail is also a slight slate-color, darker below the furrows. The breadth of the animal is very much greater than in most of our species, the head broader, blunter, the eye-peduncles shorter, heavier, and very much more widely set apart. A narrow locomotive disk below. Along the side of the foot, parallel to the base, are two furrows, rather darker in color, running upwards towards the tail, and meeting on its upper surface, above a mucus pore. The extremity of the tail broad and flattened, spade-like, usually curved at its point when the animal is in motion. The animal is more sluggish and less sensitive to the touch than the other species. Its labial tentacles are highly developed, being nearly as long as the lower feelers. Measurements of an individual in motion: Extreme length of foot 59 mill.; before shell 16 mill.; behind shell 14 mill.; of shell on back 32 mill.; of tentacles 10 mill.; breadth of head 11 mill.

Fig. 20.



Zonites capnodes.

I was at first inclined to consider it an unnaturally developed form of *fuliginosus*, but have since been convinced of its being distinct by large suites of specimens of various stages of growth. The shell is larger, heavier, less globose; the umbilicus is narrower; the aperture larger, and less-rounded; the spire less elevated. The coarse, interrupted revolving lines are present in four out of six specimens before me. The species is very variable, and in its globose form difficult to distinguish from *Z. friabilis*. It is, however, always much heavier. The globose form is figured (Fig. 20).

Jaw as usual in the genus.

Lingual membrane broad, with numerous rows of about 66—1—66 teeth. Another membrane has 70 rows of 46—1—46. Centrals long, with a long, slender, median cusp, reaching the base of attachment and bearing a long, slender point projecting beyond it. Side cusps subobsolete, but represented by the cutting points, which are greatly developed, triangular, stretching beyond the sides of the base of attachment. Lateral teeth of same type as centrals, but bicuspid; there are about 9 perfect laterals. Marginals aculeate, as usual in the genus (Pl. II. Fig. K).

I have not been able to observe the complete genital system of the species.[1] The penis has the same arrangement as in *Z. lævigatus*. The external orifice is quite under the edge of the mantle.

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[1] In the Land Mollusken of the Archip. der Philippinen (p. 78, Pl. III. Fig. 27; Pl. V. Fig. 21), Semper describes and figures a genital system, jaw, and lingual dentition, which he refers to *Z. lucubratus*, SAY. The specimen examined by him was from Tennessee. It is difficult to decide from what species Semper drew his description. It certainly was not the true *lucubratus*, which is a Mexican species. A comparison of my descriptions and figures of *lævigatus*, *inornatus*, *fuliginosus*, and *friabilis* shows that neither of those species could have been before Semper. His description of the lingual membrane would better apply to *capnodes*. I have not been able to examine the whole of the genital system to see how nearly that also agrees with his figures.

The species is readily distinguished from *Z. friabilis*, *lævigatus*, and *fuliginosus* by the number of the lateral teeth on its lingual membrane.

Zonites fuliginosus, Griff.

Vol. III. Pl. XXXI.

Shell thin, depressed on the upper surface, epidermis dark, approaching to chestnut-color, sometimes almost black, shining, and wrinkled; whorls 4½, rapidly increasing, with irregular, oblique wrinkles, the last whorl very voluminous, and expanding transversely towards the aperture; suture very little impressed; aperture very oblique, ample, lunate-ovate, within pearly or iridescent; peristome simple, thin, brittle, with a light, testaceous deposit within, the two terminations approaching each other very nearly, that of the columella somewhat reflected; umbilicus deep, not much expanded. Greater diameter 26, lesser 22 mill.; height, 13 mill.

Helix fuliginosa, Griffith, in letters; Binney, Terr. Moll., II. 222, Pl. XXXI. (1851); Bost. Journ. Nat. Hist., III. 417, Pl. XXIV. excl. syn. (1840). — Leidy, T. M. U. S., I. Pl. IX. Fig. 4 (anat.). — Adams, Shells of Vermont, 161, excl. syn. (1842). — DeKay, N. Y. Moll., 37, Pl. III. Fig. 22 (1843). — Pfeiffer, Mon. Hel. Viv., I. 88; in Chemnitz, ed. 2, II. 104, Pl. LXXXIV. Figs. 1–3. — Reeve, Con. Icon. 675 (1852). — W. G. Binney, Terr. Moll., IV. 105. — Morse, Amer. Nat., I. 315, Figs. 23, 24 (1867).

Helix capillacea, Pfeiffer, Symbolæ, II. 24, not Fér., teste Pfr.

Omphalina cuprea, Rafinesque, Enum. & Acc. 3; ed. Binney and Tryon, p. 67.

Hyalina fuliginosa, Tryon, Am. Journ. Conch., II. 248 (1866).

Zonites fuliginosus, W. G. Binney, L. & Fr.-W. Sh., I. 286 (1869). — Fischer and Crosse, Moll. Mex., 164 (1870).

A Post-pleiocene species. It now reaches its greatest development in the Cumberland Subregion, but it may extend over all the Interior Region. The extreme points from which I have actually received it are Canada, north shore of Lake Superior, and Volusia County, Florida. It is quoted doubtfully from Mexico on what seems to me most unsatisfactory authority. I have never received it west of the Mississippi River, to the south of Iowa. In all that southwestern region it seems to be replaced by *Z. friabilis*, a species which, on the other hand, does not extend, as does *fuliginosus*, northeasterly beyond the Appalachian chain.

Animal (see p. 98).

Jaw very arcuate, of almost uniform breadth, ends blunt; anterior surface with transverse striæ; concave margin simple, with a well-developed, blunt, median projection (Fig. 16, p. 95).

Lingual membrane very broad, composed of 87 rows of 129 (64—1—64) long slender teeth each; centrals tricuspid, laterals 4, bicuspid, in a straight transverse row; marginals aculeate, in a somewhat crescentic row. Another membrane had 57—1—57 teeth (Pl. II. Fig. 1).

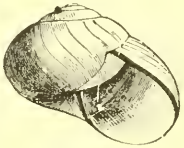
Genitalia, as well as complete anatomy, figured in Vol. I. Pl. IX. Fig. 4. There is a peculiar glandular structure around the vagina. The penis sac is long and narrow, tapering above into the vas deferens: the retractor muscle is inserted at about its middle. The genital bladder is large, oval, on a long duct. The peculiar accessories to the penis sac of *capnodes*, *lævigatus*, *inornatus*, and *friabilis* are wanting.

I have in my cabinet a large reversed specimen.

Zonites friabilis, W. G. Binn.

Shell very globose, transparent, brittle, thin, sometimes thick, shining, reddish; spire very short, conic; whorls 5, convex, lightly wrinkled, rapidly increasing, the last very large and ventricose; suture moderate; aperture circular, equally high and broad, within bluish and slightly thickened by a very thin white callus; peristome simple, sharp, thin, at its junction with the body-whorl violet-colored and reflected, so as to cover a portion of the small and deep umbilicus; the parietal wall of the aperture is covered with a light violet-colored callus. Greatest diameter 26, lesser 20 mill.; height, 13 mill.

Fig. 21.



Zonites friabilis.

Helix friabilis, W. G. Binney, Proc. Acad. Nat. Sci. Phila. 1857, 187; Terr. Moll., IV. 106, Pl. LXXX. Fig. 2. — Pfeiffer, Mon. Hel. Viv., IV. 346. — Bland, Ann. N. Y. Lyc., VII. 126.

Helix lucubrata, Pfeiffer, Mon. Hel. Viv., IV. 68; Mal. Blätt. 1858, 32, not of Say, VI. 132.

Hyalina friabilis, Tryon, Am. Journ. Conch., II. 247 (1866).

Zonites friabilis, W. G. Binney, L. & Fr.-W. Sh., I. 287, Fig. 514 (1869).

The species belongs to the Interior Region, but reaches its greatest development in the vicinity of Wabash County, Illinois. I have also received it from Indiana, from the northern and northeastern counties of Kentucky, from Franklin County, Tennessee; in the southwesterly direction, however, its range is greatest, as I have traced it to the Hot Springs of Arkansas, and to Washington County, Texas.

Animal bluish slate-color. The caudal pore, locomotive disk, and longitudinal furrows above the edge of the foot are all present.

Jaw as usual in the genus.

Lingual membrane similar in type to that above described of *Z. capnodes*. Teeth about 57—1—57, with 6 perfect laterals (Pl. II. Fig. J).

The genital system is figured on Pl. XI. Fig. D. The ovary is stout, light-brown, and blunt. The oviduct is short. The vagina is long and narrow, with a yellow prepuce-like expansion (*p p*) at the entrance of the duct of the genital bladder, which is near the base. The genital bladder is large, oval, on a duct of about equal length and size as the vagina. The penis sac is long and slender, and peculiarly characterized by a lateral bulbous expansion near its base, bearing the retractor muscle. Beyond this bulb the sac is narrow, but gradually expands, and towards its end again very gradually tapers towards the apex, where the vas deferens enters. Its orifice is side by side with that of the vagina. The external orifice of the system is under the mantle.

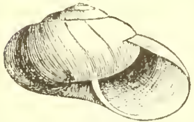
I found no dart in the bulb-like organ attached to the penis sac. It probably is a form of prostate.

The Texas specimens have a much thicker shell than those from Illinois.

Zonites caducus, Pfr.

Shell umbilicated, depressed, fragile, shortly striate, white with a reddish horn-colored epidermis; spire slightly elevated, apex delicate; whorls 5½, rather convex, the last much broader, rather flattened below, excavated around the tunnel-like minutely closed umbilicus; aperture large, obliquely oval; peristome simple, thin, with ends approaching, joined with a very light callus, the columellar one scarcely broadened. Greater diameter 27, lesser 22 mill.; height, 14 mill.

Fig. 22.



Zonites caducus.

Helix caduca, Pfeiffer, Mon. Hel. Viv., I. 89, etc. — Reeve, Con. Icon., 530. — W. G. Binney, Terr. Moll., IV. 105.

Hyalina caduca, Tryon, Am. Journ. Conch., II. 248 (1866).

Zonites caducus, W. G. Binney, L. & Fr.-W. Sh., I. 287, Fig. 513 (1869). — Fischer and Crosse, Moll. Mex., 163, Pl. VII. 3 a, 3 d (1870).

Admitted in the catalogue on the authority of Pfeiffer (Roëmer's Texas, 455), who quotes it from New Washington. It is a Mexican shell: a specimen from that locality is figured (Fig. 22).

The dentition of *Z. caducus* is known only by the description and figure of Fischer and Crosse (Moll. Mex. et Guat., 149, Pl. VIII. Figs. 13–16). There are 75—1—75 teeth, with 5 laterals.

Zonites lævigatus, Pfeiffer.

Vol. III. Pl. XXXII.

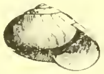
Shell somewhat convex, oftener depressed; epidermis greenish horn-color, shining, thin; whorls 5, rather flattened, rapidly enlarging, with beautiful and regular oblique striæ and revolving microscopic lines; the last whorl expanding towards the aperture, not descending; aperture transverse, broadly lunar, ample, with a testaceous deposit within; peristome thin, acute, straight, extremities approaching, its lower extremity inserted into the centre of the base, and somewhat reflected; base smooth, perforate. Greater diameter 18, lesser 15 mill.; height, 9 mill.

Helix lævigata, Pfeiffer, Mon. Hel. Viv., I. 64; III. 67 (excl. syn.); in Chemnitz, ed. 2, II. 106, Pl. LXXXIV. Fig. 17–19 (excl. syn.). — Reeve, Con. Icon., No. 672 (1852)? — DESHAYES in FÉR., I. 94, Pl. LXXXII. Fig. 6. — W. G. BINNEY, Terr. Moll., IV. 106. — BLAND. Ann. N. Y. Lyc., VII. 119 (excl. syn. *inornata*).

Helix lucubrata, BINNEY, nec SAY, Terr. Moll., II. 225, Pl. XXXII.
Helix fuliginosa, BINNEY, in Bost. Journ. (pars, excl. descr., syn., et fig.), 1840.
Helix inornata, REEVE, l. c. 666, not SAY.
Hyalina lævigata, TRYON, Am. Journ. Conch., II. 247 (1866).
Zonites lævigatus, W. G. BINNEY, L. & Fr.-W. Sh., I. 287, Fig. 515 (1869).
Zonites capnodes, part, W. G. BINNEY, l. c. Fig. 508.

Animal: head and eye-peduncles dark blue; body and foot pearly white; margin of foot furrowed, furrows meeting over posterior termination. Caudal extremity bluish above, with a gland. A distinct locomotive disk.

Fig 23.

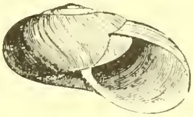


Z. lævigatus, var.

I have received specimens from Pennsylvania to Arkansas, from Illinois to St. Augustine, Florida, and Mobile. The species may therefore be said to inhabit the Interior and Southern Region. It attains its greatest development in the Cumberland Subregion.

A more globose variety is figured.

Fig. 24.



Z. lævigatus, var.

A variety from Columbus, Georgia, and Franklin County, Tennessee, is more depressed. I formerly erroneously referred this form to *Z. capnodes*.

I have given the synonymy of this species in full to show under how many names it has appeared. It seems to have been sent to Férussac by Rafinesque under the name it bears, though no description of it by the latter author is extant. Férussac mentions it by name only in his "Tableaux" (1821), with no reference, however, to the figure which afterwards appeared (1832) in the "Histoire." In 1840 Binney evidently refers to it in the "Boston Journal" as a striated variety of *fuliginosus*, and quotes Férussac's figure. He also suggests its identity with *lucubratus*. In 1848 the first description of the shell was published by Pfeiffer, whom I have given as the authority for the specific name. In continuing Férussac's great work, Deshayes also describes the shell, as does also Pfeiffer in the second edition of Chemnitz. It was therefore well established and universally known by the name of *lævigatus* when the "Terrestrial Mollusks" appeared. The name proposed by Dr. Binney would not, therefore, have precedence over Pfeiffer's, even had it been an entirely new name. Dr. Binney, however, commits the error of applying to this species Say's name of *lucubrata*, though there is no evidence of Say's ever having seen the species. On the other hand, in Mr. Poulson's collection are specimens of *lævigatus* labelled by Say "Helix ———, Claiborne, Ala." The label written during the last few years of Say's life shows conclusively his ignorance of the species.

Pfeiffer, Deshayes, Chemnitz, and Reeve have confounded *Z. inornatus* with this species, even quoting in some instances Dr. Binney's figure of *inornatus* in the "Boston Journal," which represents an entirely smooth shell. Pfeiffer also quotes *H. rufa*, DeKay, as a synonyme of *lævigata*. It seems rather to be the young of some other species.

Reeve figured *lævigatus* under the name of *inornata*, describing it as striate in the text.

Much confusion regarding the species of this group has existed also among American collectors, who have depended for the names of their shells on their friends rather than on the study of descriptions.

The species under consideration is at once distinguished from all the others of the group by the fact of its being the only one furnished with striæ on the upper surface.

Jaw as usual in the genus.

Zonites lævigatus (Pl. II. Fig. F) is peculiar in having no cutting points to the side cusps of the central teeth on its lingual membrane, and no perfect lateral teeth (see p. 97). I found in one specimen 28 rows of 19—1—19 teeth. Another specimen had 17—1—17 teeth. One half of one transverse row with the central tooth is figured on Pl. II. Fig. F. This peculiar dentition distinguishes the species from all its allies.

The ovary is short, and vagina long. The genital bladder with its duct forms a short cylindrical sac-like organ, opening near the base of the vagina and tapering at the apex. The penis sac is long, cylindrical, larger at its apex, where it receives the vas deferens. At its base the penis sac has its opening into the vagina with a short stout organ (*d, s*) with rounded apex where a retractor muscle (*r*) seems to be attached. This organ may be a dart sac or some form of prostate gland (Pl. XI. Fig. E).

Zonites demissus, Binney.

Vol. III. Pl. XLII. Fig. 1.

Shell perforated, depressed-convex; epidermis yellowish horn-color, shining; whorls 6, with minute lines of growth; spire obtuse; suture impressed; body-whorl expanding very little towards the aperture; aperture transverse, not large, slightly oblique; a white, testaceous deposit within; peristome thin, acute; base rather flat, smooth; perforation very small; umbilical region a little impressed. Greater diameter $11\frac{1}{2}$, lesser $10\frac{1}{2}$ mill.; height, 6 mill.

Helix demissa, Binney, Bost. Journ. Nat. Hist., IV. 361, Pl. XVI. Fig. 16 (1843); Terr. Moll., II. 232, Pl. XLII. Fig. 1 (1851). — Pfeiffer. Mon. Hel. Viv., I. 58; IV. 48. — Reeve, Con. Icon., No. 1491. — W. G. Binney, Terr. Moll., IV. 116.

Mesomphix demissa, Tryon, Am. Journ. Conch., II. 255 (1866).

Hyalina demissa, W. G. Binney, L. & Fr.-W. Sh., I. 45 (1869).

Zonites acerra, Lewis, Proc. Ac. N. Sc. Phila. 1875, 335.

The centre of distribution of this species seems to be the Cumberland Sub-region, where it has attained its finest growth. From here it ranges into Western Pennsylvania, North Carolina (at least as far as Goldsboro'), Georgia, Alabama to the Gulf of Mexico, and Arkansas.

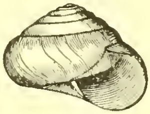
Animal light slate or smoky white, dark blue on head, eye-peduncles, and tentacles; tuberosities on back few and large; a line of furrows runs along the side of the foot, and rising on the tail meets that of the opposite side above a well-marked mucus pore. The sides, labia-like, of the pore are prominent and swollen. The pore opens and shuts, and freely exudes mucus.

Jaw as usual in the genus.

Z. demissus (Pl. II. Fig. O) has 45—1—45 teeth, with 15 laterals. My specimen was one of the large East Tennessee form, called *Z. acerrus* by Dr. Lewis (Proc. Ac. N. Sc. Phila. 1872, 110). The typical form from near Mobile has, however, a perfectly similar dentition.

The genitalia are like those of *Z. intertextus*, Binney, figured by Dr. Leidy in Vol. I. The accessory glands of the dart sac are rather shorter in *demissus*.

Fig. 25.



Z. acerrus.

The large form referred to as *Z. acerrus* above, is here figured. Its greater diameter is 20 mill.; height, 8 mill. It has over 7 whorls. From Eastern Tennessee.

Zonites ligerus, Say.

Vol. III. Pl. XXXV.

Shell perforated, orbicularly convex; epidermis yellowish horn-color, shining; whorls 7, finely and thickly striated transversely, smooth below; suture not much impressed; aperture semilunate, rounded; peristome thin, acute; base and side of the outer whorl, within the aperture, thickened and white; perforation very small; umbilical region impressed. Greater diameter 15, lesser 13 mill.; height, 10 mill.

Helix ligera, Say, Journ. Acad., II. 157 (1821); Binney's ed., 19. — Binney, Bost. Journ. Nat. Hist., III. 412, Pl. XX. Fig. 1 (1840); Terr. Moll., II. 204, Pl. XXXV. (1851). — Leidy, T. M. U. S., I. 257, Pl. XII. Figs. 4-7 (1851), anat. — DeKay, N. Y. Moll. 40, excl. fig. ? (1843). — Chemnitz, 2d ed., I. 108, Pl. XXXIII. Figs. 5-7. — Deshayes in Fér., I. 184. — Pfeiffer, Mon. Hel. Viv., I. 48. — Reeve, Con. Icon., 493 (1852). — W. G. Binney, Terr. Moll., IV. 95. — Lewis, Am. Journ. Conch., VI. 190, Pl. XII. Figs. 3, 4.

Helix Rafinesquea, Férussac, Tab. Syst., 50; Hist., Pl. LI. a, Fig. 5; Pl. L. a, Figs. 4, 5 ? — Pfeiffer, Symb., I. 39.

Helix Wardiana, Lea, Trans. Am. Phil., VI. 67, Pl. XXIII. Fig. 82; Obs., II. 67 (1839). — Troschel, Arch. fur Nat. 1839, II. 221. — DeKay, N. Y. Moll., 46.

Mesomphix ligera, Tryon, Am. Journ. Conch., II. 255 (1866).

Hyalina ligera, W. G. Binney, L. & Fr.-W. Sh., I. 44 (1869).

A species of the Interior Region, having been found from Arkansas and Georgia to the Great Lakes; north of Maryland it does not appear east of the

Appalachian chain. It is also found fossil in the Post-pleiocene of the Mississippi Valley.

Animal uniform blackish slate-color over the whole upper surface, paler on the posterior extremity and base; collar grayish-white; foot narrow, exceeding in length twice the transverse diameter of the shell; eye-peduncles long and slender. There are well-marked lines running obliquely towards the centre of the base of the foot, where is an extremely narrow line, representing, no doubt, the locomotive disk. The other characters of *Zonites* are present in the species, such as the longitudinal furrows and caudal pore.

Jaw (see Vol. I. Pl. XII. Fig. 7) strongly arcuate, ends rounded; anterior surface striated; concave margin with a well-developed median projection.

Lingual dentition (Pl. II. Fig. M). Teeth 38—1—38, with 14 laterals.

The genital system (figured by Leidy, Vol. I. Pl. XII. Figs. 4-7) is quite complicated. The genital bladder is small, oval, on a long, delicate duct, from about the middle of the length of which there is a connecting duct to the middle of the penis sac and a second duct to the apex of the dart sac. This last organ is long, large at its junction with the vagina, tapering above, and furnished below its apex with an accessory, short, delicate, cylindrical gland terminating in a small pyriform bulb. The dart is long, delicate, strictly arrow-shaped, with pointed, enlarged head and much thickened at the posterior termination. The penis sac is stout, short, receiving at its apex the vas deferens, on the commencement of which the retractor muscle is inserted.

See remarks on the genitalia of *Z. intertextus*.

Zonites intertextus, BINNEY.[1]

Vol. III. Pl. XXXVI.

Shell perforated, subpyramidal; epidermis yellowish horn-color; whorls 6 or 7, with numerous fine, oblique striæ, and very minute, spiral striæ, intersecting each other; outer whorl with a narrow, light-colored band, and an ill-defined, brownish band below it; aperture rounded, a little transverse; peristome thin, somewhat thickened within by a deposition of testaceous matter, its columellar extremity slightly reflected at its junction with the base of the shell; perforation small, sometimes nearly obsolete; base whiter than the upper surface. Greater diameter 15, lesser 13½ mill.; height, 10 mill.

Helix intertexta, BINNEY, Bost. Journ. Nat. Hist., III. 413, Pl. XX. Fig. 2 (1840); Terr. Moll., II. 206, Pl. XXXVI. — PHILIPPI, Icon., II. 9, p. 5, Pl. VI. Fig. 16. — Chemnitz, 2d ed., I. 208, Pl. XXXIII. Figs. 8-10. — PFEIFFER, Mon. Hel. Viv., I. 49. — REEVE, Con. Icon., 668 (1852). — LEIDY, T. M. U. S., I. 257, Pl. XII. Figs. 1-3 (1851) anat. — DEKAY, N. Y. Moll., 38, Pl. III. Fig. 29 (1843). — W. G. BINNEY, T. M., IV. 96.

Mesomphix intertexta, TRYON, Am. Journ. Conch., II. 254 (1866).

Hyalina intertexta, W. G. BINNEY, L. & Fr.-W. Sh., I. 44 (1869).

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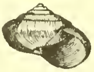
[1] It has been suggested (Proc. Phila. Ac. N. Sc. 1875, 335) that this is the *ligerus* of Say, a theory entirely refuted by a reference to Say's description of *ligerus*.

A Post-pleiocene species, now found over the whole Interior Region. The extreme points to which I have traced it are New York to Indiana, Tennessee to Georgia.

Fig. 26.



Z. intertextus, var. enlarged.

Animal resembling outwardly that of *Z. ligerus*. It has all the generic characters of *Zonites*.

The specimen figured above is unusually large. There is a smaller, strongly carinated variety with a short, conical spire, which I here figure.

This shell resembles some varieties of *Z. ligerus* so nearly, that Dr. Binney hesitated some time before he considered it distinct. The spire is less high in a shell of the same size, has a smaller number of whorls, and is more pyramidal in shape than in that species. The diameter, in full-grown specimens, is greater, and the base is flatter. The epidermis is darker and less shining, the shell is thicker and less pellucid, the deposit of testaceous matter within the aperture is less. The size of the umbilicus and the shape of the aperture are the same in both. But the principal distinction consists in the spiral lines which revolve on the whorl, intersecting the striæ of growth, but so minute as hardly to be perceptible to the naked eye, yet present in every specimen which I have examined. The whitish, narrow band, shaded below with rufous, apparent on the outer, and sometimes on the second whorl, generally aids in identifying it, though it is sometimes wanting. Young specimens are much more depressed than those of *Z. ligerus*, and are sometimes distinctly carinated. The depression of the umbilical region is not so evident in this as in the preceding species. The rufous band below the white band is well defined and broad, in a single specimen before me. Nearly allied as it is by its shell to *ligerus*, it differs in a marked manner in its genitalia (see Leidy's figure in Vol. I. Pl. XII. Fig. 1) by having a second accessory pyriform gland to the dart sac (8, 8). It may also be distinguished from *ligerus* by the greater number of the marginal teeth on its lingual membrane.

Z. intertextus (Pl. II. Fig. L) has about 61—1—61 teeth on its lingual membrane. There are 12 perfect laterals. Another specimen has 55—1—55, with 12 laterals.

Zonites subplanus, Binney.

Vol. III. Pl. XXXIII.

Shell flattened, planulate above and beneath; epidermis brownish or smoky horn-color, shining; whorls $5\frac{1}{2}$, those nearest the apex striated transversely with very minute and delicate wrinkles; suture distinct, not much impressed; aperture transverse, not expanded, the plane of the aperture making nearly a right angle with the plane of the base of the shell; peristome simple, thin, acute; base flattened, umbilical region a little impressed; umbilicus small, round, and deep, not exhibiting the volutions. Greater diameter 20, lesser 16 mill.; height, 6 mill.

Helix subplana, BINNEY, Bost. Journ. Nat. Hist., IV. Part I. cover, p. 3 (1842); IV. 241 (1842); Terr. Moll., II. 229, Pl. XXXIII. — PFEIFFER, Mon. Hel. Viv., I. 112. — W. G. BINNEY, Terr. Moll., IV. 110.

Hyalina subplana, TRYON, Am. Journ. Conch., II. 250 (1866).

Zonites subplanus, W. G. BINNEY, L. & Fr.-W. Sh., I. 288 (1869).

A species of the Cumberland Subregion, having been found in Eastern Tennessee and Lawrence County, Kentucky. It has also been found in Western Pennsylvania in the mountains.

The only American species which this shell can be said to resemble is *Z. inornatus*, which in size and color is quite like it, and at first sight may be taken for it. It differs from it in the following particulars: The upper and lower surfaces are both more flattened, and the outline is a more perfect circle. The number of whorls, in specimens of the same size, is greater by nearly one volution. The surface of the whorls is less rounded; the last whorl expands but very little towards the aperture; the base is broader, less indented, and very flat; the umbilicus is rounder, and better defined; and the aperture is not thickened within by a white, testaceous deposit.

It is an extremely rare species.

Animal unknown.

Zonites inornatus, SAY.

Vol. III. Pl. XXXIV.

Shell depressed; epidermis yellowish horn-color, smooth, shining, with very minute lines not breaking the smoothness of the surface; whorls 5; suture not much impressed; aperture transverse, scarcely oblique, obliquely lunar, with a thick, white testaceous deposit around its whole inner surface, a little distant from the margin; peristome thin, acute, fragile, its ends somewhat converging, the columellar margin reaching to the centre of the base, subdilated above; umbilicus small; base rather flattened, indented in the centre. Greater diameter 16, lesser 12½ mill.; height, 6 mill.

Helix inornata, SAY, Journ. Acad. Nat. Sci. Philad., II. 371 (1821); BINNEY'S ed. 24. — BINNEY, Bost. Journ. Nat. Hist., III. 419, Pl. XXI. Fig. 3 (1840); Terr. Moll., II. 227, Pl. XXXIV. — DEKAY, N. Y. Moll., 39 (1843). — ADAMS, Vermont Mollusca, 161 (1842). — PFEIFFER, Mon. Hel. Viv., I. 84; IV. 48. — W. G. BINNEY, Terr. Moll., IV. 109. — MORSE, Amer. Nat., I. 314, Figs. 19, 21, 22 (1867).

Helix glaphyra, PFEIFFER, olim, Symbolæ, II. 29, excl. syn. *fuliginosa;* Mon. Hel. Viv., I. 57. — REEVE, Con. Icon., 667. — Not SAY.

Helix inornata, BINNEY, not SAY, BLAND, Ann. N. Y. Lyc., VII. 127.

Hyalina inornata, TRYON, Am. Journ. Conch., II. 249 (1866).

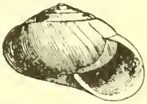
Zonites inornata, W. G. BINNEY, L. & Fr.-W. Sh., I. 289 (1869). — GOULD and BINNEY, Inv. of Mass., ed. 2, 453 (1870).

Animal with head, neck, and eye-peduncles bluish-black; foot whitish. Eye-peduncles long and slender. A marginal furrow extending along the edges of the foot, and uniting above and before its posterior termination. Behind the junction is a prominent, longitudinal, bluish-white mucus pore, on the extremity of the foot. A distinct locomotive disk.

I have received specimens from the mountainous regions of North Carolina, Kentucky, Tennessee, Virginia, Maryland, Pennsylvania, into the western part of New England; and from the States bordering on the Great Lakes. It may therefore be said to inhabit the Interior Region and the more elevated parts of the Northern Region. It was living in Post-pleiocene days.

Plate XXXIV. represents the usual form of the species. A more globose form is figured in Fig. 27. It was found in the mountains near Ashville, Buncombe Co., N. C., by Dr. Ravenel.

Fig. 27.



Zonites inornatus, var.

The shell which is described above is well known in collections, and not easily confounded with any other. It has been unfortunate in its synonymy, whose history is treated at length and explained in the fourth volume of the "Terrestrial Mollusks" and "Annals of New York Lyceum" quoted above. See also below, p. 113.

I have in my collection a curious specimen from the Pennsylvania mountains, in which are three well-developed sharp tooth-like processes on the internal thickened margin of the peristome.

My largest specimen has a greater diameter of 22 mill.

Jaw strongly arcuate, ends rapidly attenuated; anterior surface striated; concave margin smooth with an acute median projection.

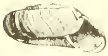
Lingual membrane with 37 rows of 23—1—23 teeth each; centrals long, slender, tricuspid; only 2 perfect laterals, stouter, bicuspid; marginals aculeate. Another membrane had 23—1—23 teeth. Another had 27—1—27 teeth, with 29 transverse rows. The transition teeth are peculiar in their base of attachment (Pl. II. Fig. II).

The genitalia have the same general arrangement as in *Z. friabilis*, already described. The ovary, however, is very much more developed, being in this species the most conspicuous organ in the system; the epididymis is less convoluted, the oviduct is longer, the vagina shorter, the genital bladder more clavate, with a shorter duct, and there is a small globular vaginal prostate (Pl. XI. Fig. C).

Zonites sculptilis, Bland.

Shell scarcely perforate, suborbicular, depressed, subpellucid, pale horn-color above, of lighter shade beneath, shining, with regular, subequidistant, impressed transverse lines, those on the last whorl extending over the periphery, and converging in the umbilical excavation; spire very little elevated, scarcely convex; whorls 7, planulate, the last rapidly increasing, equal at the aperture to one third the diameter of the shell, beneath flattened, and little excavated in the umbilical region; suture lightly impressed; aperture scarcely oblique, depressed, transverse, lunate; peristome simple, acute, sinuate, the columellar margin very rapidly and narrowly reflected over, and almost entirely covering the very small perforation. Greater diameter 12½, lesser 11 mill.; height, 5 mill.

Fig. 28.



Zonites sculptilis, enlarged.

Helix sculptilis, BLAND, Ann. N. Y. Lyc., VI. 279, Pl. IX. Figs. 11-13 (1858). — W. G. BINNEY, Terr. Moll., IV. 110, Pl. LXXVII. Fig. 15. — PFEIFFER, Mal. Blatt. 1859, 5.

Hyalina sculptilis, TRYON, Am. Journ. Conch., II. 249 (1866). — W. G. BINNEY, L. & Fr.-W. Sh., I. 290 (1869).

Anantchely Mountains, North Carolina, Eastern Tennessee, Bridgeport, Ala. It may be considered a species of the Cumberland Subregion.

In sculpture it is closely allied to *Z. indentatus*, of which it might almost be termed a gigantic variety, but the impressed striæ are more numerous, and closer together. The form of the aperture is very near that of *Z. inornatus*.

The general aspect of this shell reminds one of the Asiatic group, to which *Helix resplendens*, Phil. and *H. vitrinoides*, Desh. belong.

Animal long, slender, dirty-white, bluish on head and eye-peduncles: a distinct locomotive disk, and furrows alongside of foot, meeting over a mucus pore; tail often recurved at tip, and bearing generally a drop of mucus on it; eye-peduncles long, slender.

Jaw as usual in the genus.

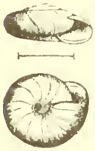
Z. sculptilis (Pl. II. Fig. P) has 40—1—40 teeth on its lingual membrane, with 4 perfect laterals.

Genitalia unobserved.

Zonites Elliotti, REDFIELD.

Shell with rather a narrow umbilicus, depressed-orbiculate, with fine transverse striæ, greenish horn-colored, hardly translucent, shining beneath; spire convex but not much raised; whorls 5, rather convex, last one sometimes very slightly depressed at the aperture; suture deeply impressed; aperture very oblique, lunate-circular; peristome a little sinuate, acute, but thickened within. Greater diameter 9, lesser 8 mill.; height, 4 mill.

Fig. 29.



Zonites Elliotti.

Helix Elliotti, REDFIELD, Ann. N. Y. Lyc., VI. 170, Pl. IX. Figs. 8-10 (1856). — GOULD, Terr. Moll., III. 23. — W. G. BINNEY, Terr. Moll., IV. 116, Pl. LXXVII. Fig. 18.

Macrocyclis Elliotti, TRYON, Am. Journ. Conch., II. 246, Pl. III. Fig. 10 (1866).

Zonites Elliotti, W. G. BINNEY, L. & Fr.-W. Sh., I. 291, Fig. 523 (1869).

Mountains of Georgia and North Carolina, and Wayne County, West Virginia. It is a species of the Cumberland Subregion.

Animal with a distinct caudal mucus pore, locomotive disk, and longitudinal furrows above the margin of the foot. It is therefore a true *Zonites*.

Jaw as usual in the genus.

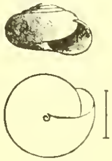
The lingual membrane (Pl. III. Fig. C) has 32—1—32 teeth, with 6 perfect laterals.

Of the genitalia I can only state the existence of the dart sac and dart as in *Z. ligerus*.

Zonites cerinoideus, Anthony.

Shell perforated, globosely flattened, shining, light horn-color, scarcely wrinkled by lines of growth; whorls 7, hardly convex, the last slightly inflated below; aperture oblique, subcircular; peristome simple, acute, its ends joined by a light callus. Greater diameter 7, lesser 6 mill.; height, 3 mill.

Fig. 30.



Zonites cerinoideus.

Helix cerinoidea, Anthony, Am. Journ. Conch., I. 351, Pl. XXV. Fig. 4 (Oct. 1865).

Mesomphix cerinoidea, Tryon, Am. Journ. Conch., II. 255, Pl. IV. Fig. 36 (1866).

Hyalina cerinoidea, W. G. Binney, L. & Fr.-W. Sh., I. 30, Fig. 30 (1869).

Jacksonville, Fla.; Charleston, S. C.; Newbern, N. C.; Norfolk, Va. It may be a species of the Florida Subregion, thence ranging northward along the Atlantic Coast.

The specimen figured was loaned by Mr. Anthony.

Animal with mucus pore, longitudinal furrows, and locomotive disk characteristic of the genus.

A form of this or some allied species furnished with two lamellar teeth within the aperture has been noticed as var. *cuspidata*, by Lewis, Proc. Phila. Ac. Nat. Sc. 1875, 334.

Jaw as usual in the genus.

Lingual membrane with 34—1—34 teeth; 9 perfect laterals (Pl. III. Fig. B).

Genitalia with dart and sac as in *Z. ligerus*.

Subgenus HYALINA, s. s.

Animal as in *Mesomphix* (see p. 98).

Shell umbilicated, sometimes perforated, depressed; shining and vitreous; whorls 5 or 6, regularly increased; spire very rarely conic-elevated; aperture rounded lunate; peristome thin, acute, straight.

Zonites cellarius, Müller.

Vol. III. Pl. XXIX. Fig. 4.

Shell very much depressed, thin, fragile, pellucid; epidermis light greenish horn-color, smooth, highly polished; whorls 5, slightly rounded, with minute and almost imperceptible oblique striæ; aperture not dilated, its transverse diameter the greatest; umbilicus moderate, regularly rounded, deep; base rounded, thickened within by a testaceous deposit, bluish-white; peristome simple, acute. Greater diameter 13, lesser 11½ mill.; height, 5 mill.

Helix cellaria, MÜLLER, Hist. Verm., II. 28. — PFEIFFER, Mon., I. 111. — BINNEY, Bost. Journ., III. 421; Terr. Moll., II. 230, Pl. XXIX. Fig. 4. — GOULD, Inv., 180, Fig. 104, excl. syn. ? (1841). — DEKAY, N. Y. Moll., 37, Pl. III. Fig. 35 (1843). — LEIDY in Terr. Moll. U. S., I. 233, Pl. VII. Fig. 1 (1851), anat. — W. G. BINNEY, Terr. Moll., IV. 111.

Hyalina cellaria, MORSE, Journ. Portl. Soc., I. 12, Figs. 18, 19, Pl. V. Fig. 20 (1864). — TRYON, Am. Journ. Conch., II. 249 (1866). — MORSE in Am. Nat., I. 541, Fig. 29 (1867). — W. G. BINNEY, L. & Fr.-W. Sh., I. 30 (1869). — GOULD and BINNEY, Invert. of Mass., ed. 2, p. 395 (1870).

Helix glaphyra, SAY, Nich., Encycl., Am. ed., Pl. I. Fig. 3, 1816; BINNEY'S ed. 7, Pl. LXIX. Fig. 3. — EATON, Zoöl. Text-Book, 194. — BLAND, N. Y. Lyc. Ann., VI. 352, not of PFEIFFER, REEVE, DESHAYES.

An European species, introduced by commerce into Philadelphia, Astoria, N. Y., Connecticut, Providence, Newport, R. I., Boston, Salem, Lynn, Marblehead, Portland, Halifax. It is common in cellars and gardens in Boston. It has also been carried to Australia.

Animal: upper surface light indigo blue, darkest on the head, neck, and eye-peduncles, collar greenish, eyes black; foot narrow and slender, not much exceeding in length the diameter of the shell, terminating acutely. A distinct locomotive disk, longitudinal furrows above the margin of the foot, uniting over a longitudinal mucus pore[1] of the same nature described under *Z. fuliginosus* (p. 98).

Jaw strongly arcuate, ends bluntly rounded; centre of anterior surface slightly striate; lower margin smooth, with a median projection.

Lingual membrane quite peculiar; the figure (Pl. II. Fig. G) shows one half of one transverse line with the median tooth; 14—1—14 teeth. The central tooth has side cusps, but not cutting points, as in *Z. lævigatus*. There can hardly be said to be one perfect lateral, the first side tooth being peculiar in having an inner side cutting point instead of the usual outer side cusp and cutting point. The second side tooth is like the first, the third is decidedly modified, the fourth is a true marginal of the usual aculeate form.

The figures of dentition of the foreign form (by Lehmann, Lindström, Semper, etc.) agree with mine.

I am not aware of this peculiar dentition having been noticed in any other species but *alliarius*.

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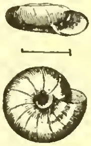
[1] No mention of the caudal pore is made by Draparnaud, Moquin-Tandon, Forbes and Hanley, Reeve, Gray, or Gwyn Jeffreys. It is also overlooked in Semper, Phil. Archip.

Genitalia (Vol. I. Pl. VII. Fig. I) with no accessory organs. The penis sac is long, tapering towards the apex, where it receives the vas deferens and retractor muscle. The genital bladder is elongate oval on a short duct. In this figure the caudal mucus pore is not shown. The penis on the outside presents a row of minute, round, glandular bodies.

Zonites Whitneyi, NEWCOMB.

Shell umbilicated, greatly depressed, thin, smooth, scarcely marked by the delicate wrinkles, shining, smoky horn-color; spire slightly elevated; whorls 4, flattened, the last planulate above and below; umbilicus broad, pervious; aperture transversely subcircular; peristome acute, simple. Greater diameter 5½, lesser 4½ mill.; height, 2 mill.

Fig. 31.



Z. Whitneyi.

Helix Whitneyi, NEWCOMB, Proc. Cal. Acad. Nat. Sci., III. 118 (1864). — PFEIFFER, Mon., V. 171 (1868).
Patula Whitneyi, TRYON, Am. Journ. Conch., II. 263 (1866).
Hyalina Whitneyi, W. G. BINNEY, L. & Fr.-W. Sh., I. 32, Fig. 37 (1869).

Inhabits the California Region in the Sierra Nevada, near Lake Tahoe, California, under damp logs and bark.

Animal not observed.

Zonites nitidus, MÜLLER.

Vol. III. Pl. XXII a. Fig. 2.

Shell orbicular, depressed, moderately convex above and concave below, thin, shining, uniform brownish horn-color, with delicate striæ of growth; whorls 5 or more, convex, separated by a deeply impressed suture, the outer one disproportionately large, somewhat declining as it approaches the aperture, and obtusely angular at the periphery, beneath excavated around a broad, crateriform umbilicus, in which the whorls are displayed to the apex; aperture oblique, lunate; peristome simple, its basal margin arcuate. Greater diameter 7½, lesser 6 mill.; height, 3⅔ mill.

Helix nitida, MÜLLER, Hist. Verm., II. 32, etc. — PFEIFFER, Mon., II. 94.
Helix lucida, DRAPARNAUD, Moll. Fr., 103, Pl. VIII. Figs. 11, 12. — BINNEY, Terr. Moll., II. 233, Pl. XXII. a, Fig. 2. — W. G. BINNEY, Terr. Moll., IV. 116.
Helix hydrophila, INGALLS in coll., unpublished.
Hyalina nitida, TRYON, Am. Journ. Conch., II. 250 (1866). — W. G. BINNEY, L. & Fr.-W. Sh., I. 31, Figs. 35, 36 (1869).

Found at Great Slave Lake, Fort Resolution in British America, and in New York and Ohio. Also in Baldwin County, Alabama. I believe, therefore, that it will be found to inhabit all of the Eastern Province, if not the whole North

American continent; also in Astoria, Oregon, which confirms this statement. It is also found in Japan, and thus, like *fulvus*, may be considered one of the circumpolar species common to the three continents.

Jaw as usual in the genus.

Lingual membrane: see Lehmann, Lebenden Schnecken, etc., p. 72, Pl. X. Fig. 23, for description and figure of the European form. In a specimen from Baldwin County, Alabama, I find 25—1—25 teeth, with 5 laterals (Pl. III. Fig. A, the left-hand figure, is an extreme marginal). Lehmann gives 28—1—28.

The specimen examined had the dart-sac and dart described in the European form.

Zonites arboreus, Say.

Vol. III. Pl. XXIX. Fig. 3.

Shell umbilicated, depressed, very slightly convex, thin, pellucid; epidermis amber-colored, smooth, shining; whorls 4 – 5, with very minute, oblique striæ, apparent when viewed with the microscope; aperture transversely rounded; peristome thin, acute; umbilical region indented; umbilicus moderate, well developed, round, and deep. Greater diameter 5, lesser $4\frac{1}{3}$ mill.; height, $2\frac{3}{4}$ mill.

Helix arborea, Say, Nich. Encyc., Pl. IV. Fig. 4; Binney's ed. 5, Pl. LXXII. Fig. 5 (1816, 1818, 1819). — Eaton,. Zoöl. Text-Book, 193 (1826). — Binney, Bost. Journ. Nat. Hist. III. 422, Pl. XXII. Fig. 1 (1840); Terr. Moll., II. 235, Pl. XXIX. Fig. 3. — DeKay, N. Y. Moll., 30, Pl. II. Fig. 10 (1843). — Gould, Invertebrata, 182, Fig. 110 (1841). — Adams, Vermont Mollusca, 160 (1842). — Pfeiffer, Mon. Hel. Viv., I. 95. — Chemnitz, 2d ed., II. 114, Tab. LXXXV. Figs. 33 – 35. — Reeve, Con. Icon., 733. — W. G. Binney, Terr. Moll., IV. 116. — Morse, Amer. Nat., I. 542, Fig. 30 (1867).

Helix Ottonis, Pfeiffer, olim, Weigm. Arch., 1840, I. 251. — Binney, Terr. Moll., II. 238, Pl. XXIX. a, Fig. 3. — W. G. Binney, T. M., IV. 117.

Hyalina arborea, Morse, Journ. Portl. Soc., I. 14, Fig. 28, Pl. VI. Fig. 29 (1864). — Tryon, Amer. Journ. Conch., II. 251 (1866). — Gould and Binney, Inv. of Mass., ed. 2, 396 (1870). — W. G. Binney, L. & Fr.-W. Sh., I. 33 (1869).

Hyalina Ottonis, Tryon, Amer. Journ. Conch., II. 251 (1866).

Helix Breweri, Newcomb, Proc. Cal. Acad. Nat. Sci., III. 118 (1864).

Hyalina Breweri, Tryon, Amer. Journ. Conch., II. 250, Pl. IV. Fig. 27 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 43, p. 66 (1869).

From Labrador to Texas and on the Rio Chama, and Fort Wingate in New Mexico; from Florida to Great Slave Lake; also in Washoe County, Nevada; in Montana; the Pacific Province from British Columbia to San Diego. It may thus be said to inhabit all North America. It is also said to be found in Cuba; also in Guadeloupe.

Jaw arcuate, narrow, with curving, pointed ends; lower margin smooth, with a wide median projection; upper margin with a corresponding depression.

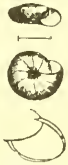
Lingual membrane with 82 rows of 21—1—21 teeth (Morse). My specimen (Pl. III. Fig. F) has about 16—1—16, with 5 perfect laterals. There are distinct side cusps as well as cutting points to the central and lateral teeth.

Animal: head, neck, and eye-peduncles blackish, or indigo blue; upper parts bluish; posterior parts whitish, transparent, sometimes wholly white. Foot thin and narrow. It has the longitudinal furrows, but on account of the transparent tissue of the foot, I find it difficult to distinguish any caudal pore.

Helix Breweri seems to me synonymous with *arboreus*, but the description and figure from "Land and Fresh-Water Shells" is here repeated.

Shell umbilicated, depressed, smooth, shining; surface unbroken by the wrinkles of growth, very light horn-color; spire scarcely elevated; whorls 4, flattened, the last depressed, shelving towards its base; umbilicus moderate; aperture transversely lunar; peristome simple, acute. Greater diameter 5 mill.; height, $2\frac{1}{2}$ mill.

Fig. 32.



Hyalina Breweri.

Near Lake Tahoe, California.

Figure 32 is drawn from an authentic specimen.

Z. arboreus is said by Gwynn Jeffreys to be nearly allied to the European *Z. excavatus* (Ann. Mag. N. H. 1872, 245).

Zonites viridulus, Menke.

Vol. III. Pl. XXIX. Fig. 1.

Shell umbilicated, small, depressed, thin, fragile; epidermis pale, or brownish horn-color, wrinkled, shining; whorls 4, the last rapidly enlarging towards the aperture; aperture transversely rounded; peristome simple, its edge rather thickened, not acute; umbilicus small, but well marked and constant. Greater diameter 5, lesser $4\frac{2}{3}$ mill.; height, 2 mill.

Helix electrina, Gould, Invert. 183, Fig. 111 (1841). — Binney, Bost. Journ. Nat. Hist., III. 423, Pl. XXII. Fig. 2 (1840); Terr. Moll., II. 286, Pl. XXIX. Fig. 1. — DeKay, N. Y. Moll., 30 (1843). — Adams, Vermont Mollusca, 161 (1842). — W. G. Binney, Terr. Moll., IV. 107. — Morse, Amer. Nat., I. 542, Fig. 31 (1867).

Helix pura, Alder, teste Pfeiffer, Mon. Hel., IV. 83.

Helix janus, Adams MS. (olim), Shells Vt. Amer. Journ. Soc. [1], XL. 273 (1841).

Zonites radiatulus, Reeve, Br. L. & Fr.-W. Sh., 50, Fig. (1863).

Zonites striatula, Moquin-Tandon, Moll., Fr. teste Reeve.

Helix viridula, Menke, Syn. Méth., ed. 2, 127; see also Mal. Blätt., VIII, 92.

Hyalina electrina, Morse, Journ. Portl. Soc., I. 13, Fig. 23, Pl. VI. Fig. 24 (1864). — Tryon, Amer. Journ. Conch., II. 251 (1866).

Hyalina viridula, W. G. Binney, L. Sh., I. 34 (1869). — Gould and Binney, Inv. of Mass., ed. 2, 397 (1870).

A circumpolar species common to the three continents. In America it has been found from Great Slave Lake to the Gulf of Mexico; in the Central Province, in Arizona, Colorado, and New Mexico. I have not actually, as yet, received it from the Pacific Province, but have no doubt it will be proved to inhabit all the North American continent.

Animal bluish-black. I have not verified the existence of a caudal pore or other generic characters.

Jaw arcuate, ends attenuated, pointed; concave margin smooth, with a median rounded projection.

Lingual membrane (Pl. III. Fig. E). Morse gives 54 rows of 27—1—27 teeth each. I have figured the central and first lateral, with one extreme marginal tooth, drawn from a specimen furnished me by Mr. Allen of Orono, Me. I find 3 lateral teeth. Morse gives a similar figure. The European *Z. viridulus* as figured by Lehmann (*Z. purus*) has a similar dentition, excepting size of central tooth; he gives 23—1—23 teeth, with 3 laterals. ·There are distinct side cusps as well as cutting points to centrals and laterals.

In size, the depressed-conical shape of the upper surface, the number of whorls, and the rapid enlargement of the largest whorl, this shell corresponds with *Z. indentatus*. It differs in its darker, smoky horn-color, its constant umbilicus, its rather thick and shining peristome, and in its whitish wrinkles, which, instead of being remote, are crowded. From *arboreus* it differs in having one whorl less, the last one rapidly dilating, its apex not being depressed, its thinner structure and more glossy surface, and in its somewhat smaller umbilicus. In *arboreus* the peristome has a flexuous curve, but is nearly a direct section of the whorl in this. Though all of the same size and general appearance, the three may be readily separated when mingled. Indeed, its claims as a distinct species are not very obvious without viewing the three together. It is found abundantly under fragments of wood, in damp places near the water's edge, in company with *Z. fulvus* and *arboreus*, and *Vertigo modesta*. On its upper surface it appears to be identical with *Z. indentatus;* while on the base its resemblance to *Z. arboreus* is striking. It appears to be a widely diffused and very common species.

Mr. Gwynn Jeffreys calls the American form *Z. radiatulus* var. *albus* (Ann. Mag. N. H. 1872, 245).

Genitalia unknown.

Zonites indentatus, SAY.

Vol. III. Pl. XXIX. Fig. 2.

Shell subperforated, flattened, thin, pellucid; epidermis highly polished, corneous; whorls rather more than 4, rapidly enlarging, with regular, subequidistant, radiating, impressed lines, which on the body-whorl extend to the centre of the base, outer whorl expanding towards the aperture; suture well impressed; aperture rather large, transverse; peristome simple, acute, very thin, at its inferior extremity terminating at the centre of the base of the shell;

umbilicus none, but the umbilical region is indented. Greater diameter 5, lesser 4½ mill.; height, 2½ mill.

Helix indentata, SAY, Journ. Acad., II. 372 (1822); BINNEY's ed., 24. — BINNEY, Bost. Journ. Nat. Hist., III. 415, Pl. XXII. Fig. 3 (1840); Terr. Moll., II. 242, Pl. XXIX. Fig. 2. — DEKAY, N. Y. Moll., 31, Pl. III. Fig. 26 (1843). — GOULD, Invert., 181, Fig. 109 (1841). — ADAMS, Vt. Moll., 160 (1842). — CHEMNITZ, 2d ed., I. 21, Pl. XXXIV. Figs. 12-15. — PFEIFFER, Mon. Hel. Viv., I. 59. — REEVE, Con. Icon., 730 (1852). — W. G. BINNEY, Terr. Moll., IV. 119. — MORSE, Amer. Nat., I. 413, Fig. 28 (1867).

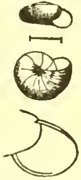
Hyalina indentata, MORSE, Journ. Portl. Soc., I. 12, Fig. 21, Pl. II. Fig. 11; Pl. V. Fig. 22 (1864). — TRYON, Amer. Journ. Conch., II. 246, 411 (1866). — W. G. BINNEY, L. & Fr.-W. Sh., I. 35, Fig. 45 (1869). — GOULD and BINNEY, Invert. of Mass., ed. 2, p. 398 (1870).

Inhabits all of the Eastern Province, having been found from Canada to Texas, and from Dakota to Florida. Also the Central Province, having been found in Utah, and I doubt not its eventually being found also over the Pacific Province, especially on the mountains. It is also said to occur in St. Domingo and Porto Rico.

Animal bluish-black on the upper parts; margin and posterior extremity lighter. A distinct caudal mucus pore.

A variety with an open umbilicus is sometimes found (Fig. 33).

Fig. 33.



Z. indentatus, var.

Jaw somewhat arcuate, long, narrow, ends somewhat attenuated, pointed; concave margin smooth, with a slightly developed, broad median projection.

Lingual membrane very broad, with 53 rows of 79 teeth each (39—1—39); another membrane had 38—1—38, also with 3 perfect laterals; centrals tricuspid, the median cusp very large and longer than the base of attachment; laterals 3 only on each side, bicuspid, arranged in a straight transverse row; marginals aculeate (Pl. III. Fig. G).

Genitalia not observed.

Zonites limatulus, WARD.

Vol. III. Pl. XXX. Fig. 3.

Shell widely umbilicated, small, depressed, thin; epidermis whitish, immaculate; suture distinctly impressed; whorls more than 4, convex, with very fine, oblique, parallel striæ, which become obsolete on the base; aperture oblique, subcircular, slightly modified by the penultimate whorl; peristome thin, acute, its ends approaching; umbilicus rounded, large, and deep, not exhibiting all the volutions. Greater diameter 5½, lesser 5 mill.; height, 2⅓ mill.

Helix limatula, WARD, MSS. in BINNEY, Bost. Journ. Nat. Hist., III. 434, Pl. XXI. Fig. 2 (1840); Terr. Moll. U. S., II. 219, Pl. XXX. Fig. 3. — PFEIFFER, Mon. Hel. Viv., I. 113; IV. 85. — W. G. BINNEY, Terr. Moll., IV. 100.

Pseudohyalina limatula, Tryon, Amer. Journ. Conch., II. 264 (1866).
Hyalina limatula, W. G. Binney, L. & Fr.-W. Sh., I. 36 (1869).

I have actually received specimens from New York to Michigan, and from San Mateo, California. I believe it will prove, therefore, to have as wide a distribution as many of the other minute species.

The animal has the longitudinal furrows along the side, above the foot, and the caudal mucus slit, as in *Zonites suppressus*. In two individuals examined I found the sac and dart as figured by Leidy in *Z. ligerus* (Vol. I. Pl. XII. Fig. 3).

Jaw as usual in the genus.

The lingual membrane (Pl. II. Fig. N) has 23—1—23 teeth, with 5 laterals.

Zonites minusculus, Binney.

Vol. III. Pl. XVII. Fig. 2.

Shell umbilicated, minute, depressed-convex; epidermis whitish; whorls 4, convex, not increasing rapidly in diameter, with microscopic wrinkles; suture very distinctly impressed; aperture nearly circular; peristome thin, acute; umbilicus large, not spread, deep, and exhibiting the volutions; base rounded, columella with a thin callus. Greater diameter 2½, lesser 2⅓ mill.; height, 1 mill.

Helix minuscula, Binney, Bost. Journ. Nat. Hist., III. 435, Pl. XXII. Fig. 4 (1840); Terr. Moll., II. 221, Pl. XVII. Fig. 2, excl. syn. — Adams, Vt. Moll., 161 (1842). — Chemnitz, 2d ed., II. 112, Tab. LXXXV. Figs. 20-23. — Pfeiffer, Symbol., II. 33; Mon., I. 114. — Reeve, Con. Icon., 731 (1852). — W. G. Binney, Terr. Moll., IV. 102. — Morse, Amer. Nat., I. 543, Fig. 35 (1867).
Helix minutalis, Morelet, nec Fér. Test. Nov., II. 7.
Helix apex, Adams, Contr. Conch., 36. — Reeve, l. c. 339.
Helix Lavelleana, D'Orbigny, Moll. Cub. in text, 161, excl. Pl. (1853).
Helix Mauriniana, D'Orbigny, l. c. in Pl. VIII. Figs. 20-22, excl. text.
Pseudohyalina minuscula, Morse, Journ. Portl. Soc., I. 16, Fig. 34, Pl. VII. Fig. 35 (1864). — Tryon, Amer. Journ. Conch., II. 264 (1866).
Hyalina minuscula, W. G. Binney, L. & Fr.-W. Sh., I. 37 (1869).
Zonites minusculus, Fischer and Crosse, Moll. Mex., 175 (1870).

From the Red River of the North to Arkansas, Texas, and Florida. It may thus be said to inhabit all the Eastern Province; in the Central Province in Arizona; has lately been found in California, and has been traced through Mexico into Yucatan; is quoted from Bermuda, Cuba, Jamaica, and Porto Rico. In Japan it has also been noticed (Ann. Mag. Nat. Hist., June, 1868). I am inclined to believe, therefore, that it will prove, like *Z. fulvus*, to be one of the circumpolar species common to the three continents.

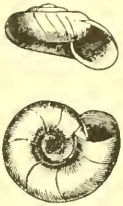
Jaw long, narrow, but slightly arcuate, of almost uniform width, ends rounded; concave margin smooth, with a slightly developed, broad, median projection.

Lingual membrane (Pl. III. Fig. II). Morse's figure shows 4 perfect laterals. He counted 52 rows of 12—1—12 teeth. It will be noticed that his figure does not show the cutting points of the side cusps of the central and lateral teeth, which I have found in specimens lately examined from Florida. I found a similar number of teeth.

Zonites milium, Morse.

Shell widely umbilicated, depressed, transparent, shining, white, with a greenish tinge, marked with distinct and regular striæ of growth and microscopic revolving lines, the latter more conspicuous below; spire but slightly elevated; whorls 3, rounded, rapidly increasing, the last planulate above, widely umbilicated below; aperture very oblique, subcircular, remote from the axis; peristome simple, acute, its terminations somewhat approached, that of the columella not reflected. Greater diameter $1\frac{1}{2}$ mill.; height, $\frac{1}{2}$ mill.

Fig. 34.



Z. milium, enlarged.

Helix milium, Morse, Proc. Bost. Soc., VII. 28 (1859). — W. G. Binney, Terr. Moll., IV. 101. Pl. LXXIX. Figs. 4, 5. — Morse, Amer. Nat., I. 543, Fig. 36 (1867).

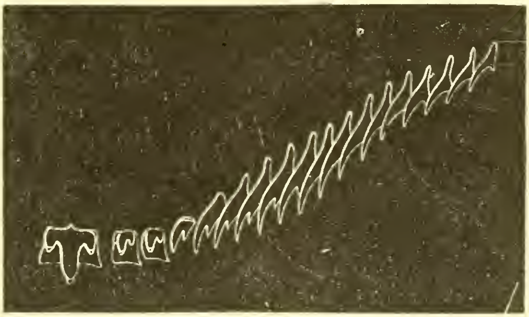
Striatura milium, Morse, Journ. Portl. Soc., I. 18, Figs. 41, 42, Pl. VII. Fig. 43 (1864).

Pseudohyalina milium, Tryon, Am. Journ. Conch., II. 265 (1866).

Hyalina milium, W. G. Binney, L. & Fr.-W. Sh., I. 38 (1869). — Gould and Binney, Inv. of Mass., ed. 2, 401 (1870).

Massachusetts and Maine; Campbell County, Kentucky. It has also been noticed in Monterey, near San Francisco, and Nevada County, California. I doubt not that it will be found over the whole continent.

Fig. 35.



Lingual Dentition of *Z. milium*.

The surface of the shell is raised in numerous rib-like folds, frequently anastomosing: longitudinal ribs reticulate the surface and render the folds so crenulated that in certain lights the shell appears as if ornamented with strings of beads. This peculiar character disappears at the base of the shell, and is replaced by revolving lines and regular lines of accretion.

Genitalia not observed.

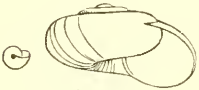
Z. milium is described by Morse as having 68 rows of 17—1—17 teeth on its lingual membrane, with only 2 perfect laterals. The next six teeth are shown to be bifid, not only the one or two transition teeth, but the decided marginals. I have also drawn the membrane of this species (Pl. III. Fig. M). I found 18—1—18 teeth, with 3 laterals. The peculiarity of the lingual of this species is the great development of the central tooth.

The jaw also is peculiar in having vertical channels worn upon its anterior surface, extending down to the cutting margin as in the following species. These channels are probably worn by the greatly developed central tooth of the lingual membrane. I do not agree with Morse in considering the great development of the central tooth and the channels on the jaw as generic characters.

Zonites Binneyanus, Morse.

Shell umbilicated, subglobose, transparent, almost colorless, shining, smooth, with microscopic wrinkles of growth and still more delicate oblique wrinkles: spire not much elevated; whorls about 4, rounded, gradually enlarging, the last globose, broadly umbilicated below; aperture oblique, subcircular, large; peristome simple, acute, extremities not approaching, that of the columella subreflected. Greatest diameter, 4 mill.; height 2 mill.

Fig. 36.



Z. Binneyanus.

Hyalina Binneyana, Morse, Journ. Portl. N. H. Soc., I. 13, Figs. 25, 26; Pl. II. Fig. 9; Pl. VI. Fig. 27 (1864). — Tryon, Amer. Journ. Conch., II. 252 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 39 (1869). — Gould and Binney, Invert. of Mass., new ed., 400 (1870).

Helix Binneyana, Morse, Amer. Nat., I. 542, Fig. 32 (1867).

Southern part of Maine; Tawas Bay, Michigan; Massachusetts. It may be considered peculiar to the Northern Region.

Jaw very broad, arched, ends attenuated, bluntly rounded; concave margin with a small rounded median projection, on either side of which are two smaller projections (Morse).

Lingual membrane described by Morse with 60 rows of 23—1—23 teeth; centrals tricuspid; laterals 2, bicuspid, but with a third cusp-like process on the inner side; marginals aculeate. On Pl. III. Fig. I, I give a figure of the teeth on a membrane examined by me, kindly furnished by Mr. Anson Allen, of

Orono, Maine. I find 19—1—19 teeth, with 3 laterals. I doubt there being any inner cutting points to the lateral teeth, as observed by Mr. Morse on the lingual examined by him.

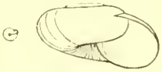
In Am. Journ. Conch. I. 188, Mr. Tryon proposes for this species the name *Morsei*, on account of *Helix Binneyana*, Pfr. I have retained Morse's name, as it is not preoccupied in the genus *Zonites*. In his first catalogue of Maine Shells, Mr. Morse uses the name *Binneyi*, which can be employed, if necessary, to distinguish the species from Pfeiffer's.

Genitalia not observed.

Zonites ferreus, Morse.

Shell umbilicated, depressed-globose, transparent, of a very light steel-gray color, not shining, marked with very delicate incremental wrinkles and microscopic revolving lines; spire slightly elevated; whorls 3, rounded, the last rapidly enlarging, globose; aperture large, transversely subcircular; peristome simple, acute, its extremities not approaching, that of the columella scarcely subreflected. Greatest diameter, $2\frac{1}{2}$ mill.; height, $1\frac{1}{4}$ mill.

Fig. 37.



Z. ferreus.

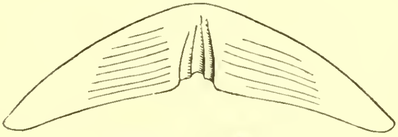
Striatura ferrea, Morse, Proc. Portl. S. N. H., I. 17, Figs. 36-40, and Pl. II. Fig. 10 (1864).

Hyalina ferrea, Tryon, Amer. Journ. Conch., II. 253 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 40 (1869). — Gould and Binney, Invert. of Mass., ed. 2, 401 (1870).

Helix ferrea, Morse, Amer. Nat., I. 544, Fig. 37 (1867).

Maine: a species of the Northern Region.

Fig 38.



Jaw of *Z. ferreus* (Morse).

Jaw angularly arched, ends tapering, acute; anterior surface deeply channelled in its centre; concave margin smooth, with a deep, median indentation, probably worn by the greatly developed central tooth of the lingual membrane.

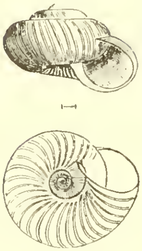
Lingual membrane with 39 curving rows of 20—1—20 teeth; centrals enormously developed, very broad, tricuspid, the middle cusp very broad; two bicuspid laterals on each side, the inner much the smaller; marginals aculeate. Another membrane (Pl. III. Fig. P), had also 20—1—20 teeth, with 2 perfect laterals.

Genitalia unobserved.

Zonites conspectus, Bland.

Shell umbilicate, subdepressed, thin, with oblique, rather distant rib-like striæ, the interspaces microscopically striate, dark horn-colored; spire convex, with smooth, obtuse apex; suture deep; whorls 4, convex, gradually increasing, the last broader, rounded, slightly descending above; umbilicus about

Fig. 39.



Z. conspectus, enlarged.

equal to two sevenths the diameter of the shell; aperture oblique, roundly lunate; peristome simple, straight, the margins approaching, the columellar margin scarcely dilated. Greater diameter 2, lesser $1\frac{3}{4}$ mill.; height, 1 mill.

Helix conspecta, Bland, Ann. N. Y. Lyc. VIII. 163, Fig. 7 (Nov. 1865).

Pseudohyalina conspecta, Tryon, Amer. Journ. Conch., II. 265 (1866).

Hyalina conspecta, W. G. Binney, L. & Fr.-W. Sh., I. 41 (1869).

In the Pacific Province at San Francisco and Monterey, California. In the Central Province at Cunningham Gulch, Colorado.

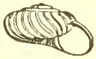
Z. conspectus differs from *Patula asteriscus* in having an elevated spire and a smaller umbilicus. The rib-like striæ are more numerous, but scarcely raised above the surface of the shell, which, under the microscope, is very similar to that of *H. asteriscus*. *Z. exiguus* also has very prominent ribs, but they are independent of the striæ of growth and run obliquely to them.

Animal not observed.

Zonites exiguus, Stimpson.

Shell broadly umbilicated, depressed, pellucid, greenish horn-color, marked with delicate revolving lines, and distant longitudinal ribs obliquely decussating the incremental striæ; spire scarcely elevated, apex free from striæ; whorls $3\frac{1}{2}$, convex, the last rounded, widely umbilicated below; aperture oblique, transversely rounded, remote from the axis; peristome simple, acute, its columellar extremity not reflected. Greater diameter, $2\frac{1}{2}$ mill.; height, $\frac{1}{2}$ mill.

Fig. 40.



Z. exiguus, enlarged.

Helix exigua, Stimpson, Proc. Bost. Soc., III. 175 (1850). — Gould, T. M., III. 16. — W. G. Binney, T. M., IV. 102, Pl. LXXVII. Fig. 19. — Pfeiffer, Mon. Hel. Viv., III. 102. — Morse, Amer. Nat., I. 543, Fig. 34 (1867).

Helix annulata, Case in Sill. Journ. [2] 1847, III. 101, Figs. 1 - 3; Ann. and Mag. Nat. Hist. 1847, 338, preocc.[1] — Pfeiffer, Mon., III. 103.

Helix striatella, junior, teste Gould, Sill. Journ., III. 276 (1847).

Pseudohyalina exigua, Morse, Journ. Portl. Soc., I. 16, Pl. II. Fig. 8; Pl. VII. Fig. 33 (1864). — Tryon, Amer. Journ. Conch., II. 265, Pl. IV. Fig. 57 (1866).

Hyalina exigua, W. G. Binney, L. & Fr.-W. Sh., I. 42 (1869). — Gould and Binney, Inv. of Mass., ed. 2, 400 (1870).

A species of the Northern Region, noticed hitherto in Canada, New York, and New England; Tawas Bay, Michigan.

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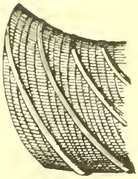
[1] This name is preoccupied in *Helix*, not in *Zonites*, and should be adopted, according to the strict laws of nomenclature.

Fig. 41 shows the peculiar sculpturing of this species.

Jaw very low, wide, but slightly arcuate: no median prominence to the cutting margin.

The lingual membrane has 69 rows of 16—1—16 teeth each; centrals with one long, slender, middle, and two short side cusps; laterals 4, of same shape, but bicuspid; marginals aculeate, diminishing greatly in size as they pass off laterally. The transition teeth and several of the adjoining marginals are described by Morse with a small side spur to their cusps, apparently of the same type as I have figured for *Macrocyclis Vancouverensis* (Pl. I. Fig. B). On Pl. III. Fig. D, I give a drawing of a specimen examined by me. I found 16—1—16 teeth, with 5 laterals.

Fig. 41.

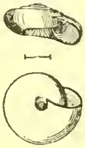


Surface of *Z. exiguus.*

Zonites chersinellus, Dall.

Shell narrowly umbilicated, depressed, transparent, lightest horn-color, shining, with distant incremental wrinkles; spire slightly elevated; whorls 4, scarcely convex, the last depressed-globose; umbilicus narrow, pervious; aperture oblique, lunately subcircular; peristome simple, acute. Greater diameter, 3 mill.; height, 1 mill.

Fig. 42.



Z. chersinellus.

Helix (Conulus) chersinella, Dall, Amer. Journ. Conch., II. 328, Pl. XXI. Fig. 4 (1866).

Conulus chersinella, Tryon, Amer. Journ. Conch., III. 162 (1867).

Hyalina chersinella, W. G. Binney, L. & Fr.-W. Sh., I. 47 (1869).

"Big Trees," Calaveras County, California: it must be considered a species of the California Region.

The description and figure are drawn from an authentic specimen

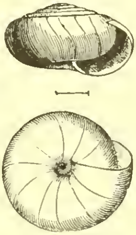
Animal not observed.

Zonites capsella, Gould.

Vol. III. Pl. XXIX a. Fig. 2.

Shell quite small, planorboid, pellucid, glistening, amber-colored; spire nearly plane, composed of about $6\frac{1}{2}$ closely revolving, flattened whorls; surface with distant, impressed, radiating striæ; suture margined; aperture narrow, semilunar; peristome simple, not thickened by callus within; base perforated by a deep, rather small, funnel-shaped umbilicus. Greater diameter, 5 mill ; height, $2\frac{1}{2}$ mill.

Fig. 43.



Z. capsella.

Helix rotula, Gould, Proc. Bost. Soc., III. 38 (June, 1848). — Pfeiffer, Mon. Hel., III. 107, preocc.[1]

Helix capsella, Gould in Terr. Moll., II. 239, Pl. XXIX. a, Fig. 2. — W. G. Binney, Terr. Moll., IV. 117. — Lewis, Amer. Journ. Conch., VI. 188, Pl. XII. p. 12 (1871).

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[1] The strict rules of nomenclature would require the use of Gould's first name, *rotula*, which is not preoccupied in *Zonites*.

Hyalina capsella, Tryon, Amer. Journ. Conch., II. 252 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 76, Fig. 72 (1869).

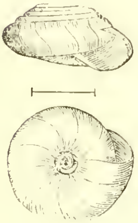
Mountains of Eastern Tennessee: a species of the Cumberland Subregion.

Animal unknown.

Formerly I referred as a synonyme to this species, *Z. placentula*, q. v., describing and figuring the animal and dentition. I am, however, now convinced of its difference. See below.

Zonites placentula, Shuttleworth.

Fig. 44.



Z. placentula.

Shell widely umbilicated, very much depressed, arctispiral, very shining, marked by irregular, distant, impressed striæ, horn-color, diaphanous, below of uniform color: whorls 7, most gradually increasing, scarcely convex, the last convex below, subexcavated around the umbilicus; aperture oblique, lunate; peristome simple, acute. Greater diameter $7\frac{1}{2}$, lesser $6\frac{1}{4}$ mill; height, 3 mill.

Near *Z. demissus*, but most readily distinguished by its more depressed shell, its wider umbilicus, and especially by the absence of the heavy opaque white callus in the aperture on the base of the last whorl (Shuttl.).

Zonites placentula, Shuttleworth, Bern. Mit. 1852, 194. — Gould in Terr. Moll., III. 19. — Pfeiffer, Mon., III. 631.

A species of the Cumberland Subregion, having been received from the mountainous region of Tennessee (Jalapa, etc.); from Whitley County, Kentucky, from Lexington, Virginia. I have also received it from the Hot Springs of Arkansas, proving that it has the southwestern range beyond this subregion noticed in many of its species. It is also quoted, but I think incorrectly, from Colorado by Ingersoll.

Animal with distinct locomotive disk, longitudinal furrows, and caudal mucus pore.

Jaw as usual in the genus.

The lingual membrane (Pl. III. Fig. L) has 25—1—25 teeth, with 3 perfect laterals, and 1 transition tooth.

This species has been confounded with *Z. capsella*, but differs greatly in many particulars, especially in its general outline, number of whorls, width of umbilicus. There are sometimes 8 full whorls.

Subgenus CONULUS, (Fitz.) Moq.-Tand.

Animal (of *Z. fulvus*) bluish-black upon the head, neck, and eye-peduncles, lighter on the sides and base; foot very narrow, thread-like. A distinct caudal mucus pore.

Shell imperforate, or very narrowly perforate, turbinate, arcti-spiral; whorls 5 – 6, rather convex; aperture depressed-lunar, the penultimate whorl strongly excided, somewhat oblique. Peristome with margins separated.

Zonites fulvus, Draparnaud.

Vol. III. Pl. XVII. Fig. 4.

Shell imperforate, sub-conical, thin, pellucid; epidermis smooth, shining, minutely striated, amber-colored; whorls 5 or 6, rounded, very narrow; suture distinct and deep; aperture transverse, narrow; peristome simple, acute; base convex; umbilical region indented, umbilicus closed. Greater diameter 4, lesser 3½ mill; height, 3 mill.

Helix chersina, Say, Journ. Phila. Acad., II. 156 (1821); Binney's ed. 18, 81. — Binney, Bost. Journ. Nat. Hist., III. 416, Pl. XXVI. Fig. 3 (1840); Terr. Moll., II. 243, Pl. XVII. Fig. 4. — Gould, Invertebrata, 185, Fig. 105 (1841). — Adams, Vermont Mollusca, 162 (1842); Sillim. Journ. [I], XL. 273. — DeKay, N. Y. Moll., 44, Pl. XXXV. Fig. 338 (1843). — W. G. Binney, Terr. Moll., IV. 119. — Morse, Amer. Nat., I. 544, Fig. 38 (1867).

Helix egena, Say, Journ. Phila. Acad., V. 120 (1825); Binney's ed. 30. — DeKay, N. Y. Moll., 45 (1843). — Chemnitz, ed. 2, I. 237, Pl. XXX. Figs. 19-21? (1846). — Reeve, Con. Icon., No. 1263 (1854). — Pfeiffer, Mon. Hel. Viv., I. 31, not of Gould in Terr. Moll.

Helix fulva, Draparnaud, Mighels, Bost. Journ., IV. 333, — Chemnitz, Pfeiffer (Mon. H., I. 30), Reeve, Forbes and Hanley.

Conulus chersinus, Morse, Journ. Portl. Soc. I. 19, Figs. 44, 46; Pl. II. Fig. 4; Pl. VII. Fig. 45 (1864).

Conulus chersina, Tryon, Am. Journ. Conch. II. 256 (1866).

Hyalina fulva, W. G. Binney, L. & Fr.-W. Sh., I. 46, Fig. 73 (1869).

Hyalina chersina, Gould and Binney, Invert. of Mass., new ed. 402 (1870).

A circumpolar species, common to the three continents. It appears to inhabit all of the Eastern Province, having been found from Great Slave Lake to Texas and Florida. In the Pacific Province it has been found in Sitka, and at Lake Tahoe and San Gorgonio Pass in California. In the Central Province in Colorado and Nevada. It may eventually be found to inhabit the whole North American continent.

Animal bluish black upon the head, neck, and eye-peduncles, lighter on the sides and base; foot very narrow, threadlike, with a caudal mucus pore.

Jaw arcuate, ends attenuated; anterior surface smooth; concave margin smooth, with an obtuse median projection.

Lingual membrane: Morse gives 80 rows of 18—1—18 teeth, with 7 laterals. The specimen examined by me (from Orono, Maine) has 30—1—30 teeth, with 8 perfect laterals. The difference in the number of the marginals is unusual for two individuals of the same species.

The peculiarity of the lingual is the bifurcation of all the marginal teeth. On Pl. II. Fig. E, I have drawn one central with its adjacent lateral, and one marginal extracted from a Maine specimen.

By the bifurcation of the marginals this species is allied to *Vitrinoconus*

(Semper, Phil. Archip.); also *Z. Gundlachi*, which, however, has some of its marginals even tricuspid, and tricuspid laterals.

The American form here under consideration was described by Mr. Say under the name *chersina*. Judging from its shell alone, it seems identical with the European *Z. fulvus*. It has thus been considered one of the circumpolar species common to the three continents, and is so treated above. My confidence of this identity, however, is now shaken by a study of the description and figure by Lehmann (Lebenden Schnecken, etc., p. 79, Pl. X. Fig. 24), of the dentition of the European *Z. fulvus*. He gives 86 - 100 rows of 25—1—25 teeth; the first two laterals he makes tricuspid, while they are only bicuspid in our form. The marginals appear to be bifid. The question of identity must therefore, I fear, be considered as still open.

It is found under, and in the interstices of wet, decaying wood, under layers of damp leaves in forests, and under fragments of wood on the borders of ponds.

The above-named localities prove this to be a widely spread species. Its diminutive size has probably prevented its being observed in other places. It offers but few varieties, and is easily distinguished by its conical form, and thin, amber-colored, transparent shell. It is a very beautiful and delicate little species. The spire is elevated, turreted, attaining even seven full volutions, with an obtuse apex; at other times it is much lower, with a somewhat pointed apex, and not exceeding five volutions. In the latter case, the base is of course much broader in proportion to the height, and the outer whorl is obtusely carinated. This carinated form is *H. egena* of Say, of which Dr. Binney writes: —

"I have recently examined the original specimen of the shell described by Mr. Say as *Helix egena*, and by him deposited in the collection of the Academy of Natural Sciences, in Philadelphia. I could not, on careful comparison, detect any difference between it and the depressed variety of *H. chersina*. Mr. J. S. Phillips, the obliging curator of the department of Conchology in that institution, joined me in the opinion that the two are clearly identical." The elevated form only is figured in the "Terrestrial Mollusks." It is interesting to state that in Europe also these two extreme forms are known to exist, the analogue of *egena* being called *Mortoni* (Jeffreys).

The plane of the base is so nearly horizontal that the shell, when set upon its base, is upright. It is so transparent that some of the sutures of the spire are visible through the substance of the shell, when viewed on the base.

There is a variety with an internal tooth.

Zonites Fabricii, Beck.

Shell subimperforate, conical, thin, lightly striated, pellucid, reddish; spire conical, rather acute; suture profound; whorls 6, convex, narrow, the last wider, rather convex at base, impressed at the centre; aperture vertical, widely lunar; peristome simple, acute, its columellar extremity reflected above, simulating a perforation. Greater diameter 4, lesser 3½ mill.; height, 3 mill.

Helix Fabricii, Beck, Ind. 21, no descr. — Möller, Ind. Moll. Gr., 4 (1842). — Pfeiffer, Zeit. f. Mal. 1848, V. 90; Mon. Hel. Viv., III. 32. — Reeve, Con. Icon., No. 1459. — W. G. Binney, T. M. U. S., IV. 120.

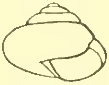
Helix Hammonis, Ström. Trondh. selsk. skrift., III. 425, Pl. IV. Fig. 16.

Helix nitida, Fabricius, Fauna Gr. 389 (doubted by Mörch, l. c.).

Conulus Fabricii, Mörch, Nat. Bidr. af Gr., 75 (no descr.). — Tryon, Am. Journ. Conch., II. 256 (1866). — Mörch, Am. Journ. Conch., IV. 29, Pl. III. Fig. 5 (1868).

Hyalina Fabricii, W. G. Binney, L. & Fr.-W. Sh., I. 47 (1869).

Fig. 45.



Z. Fabricii, enlarged.

Greenland.

Animal black, mantle dirty yellow, with black spots, which are to be seen through the shell. Foot long, narrow. Eye-peduncles long, and proportionally rather thick. Tentacles short, blunt (Mörch).

Fig. 45 is copied from an original drawing by Mörch, l. c. I have not seen the species, which certainly must be nearly allied to, if not identical with, *fulvus*.

Zonites Gundlachi, Pfeiffer.

Vol. III. Pl. XXII. A, Fig. 3.

Shell perforated, depressed-conic, rather solid, pale rusty-brown, striated with numerous faint lines of growth; spire elevated, having about five closely revolving, well-rounded whorls, separated by a very deep suture; periphery rounded; base convexly rounded, and excavated around a small, deep perforation; aperture nearly circular, interrupted for a short space by the penultimate whorl; peristome simple, slightly expanded, and at the columellar region decidedly reflexed. Greater diameter 2½, lesser 2¼ mill.; height, 1⅔ mill.

Helix Gundlachi, Pfeiffer, Wiegm. Arch. 1840, I. 250; Mon. Hel. Viv. I. 50; in Chemnitz, ed. 2, I. 239, Pl. XXX. Figs. 25–28. — W. G. Binney, Terr. Moll., IV. 121.

Helix pusilla, Pfeiffer, Arch. f. Nat. 1839, I. 351, nec Lowe.

Helix egena, Gould in Terr. Moll., II. 245, Pl. XXII. a, Fig. 3. not of Say.

Conulus Gundlachi, Tryon, Am. Journ. Conch., II. 256 (1866).

A species of the Florida Subregion. Also in Cuba and St. Thomas, Porto Rico, Viéque, Guadeloupe. Tate (Amer. Journ. Conch., V. 155) quotes it from Nicaragua. The species observed by him has the caudal generic characters (not dentition) of *Guppya*.

The species is viviparous.

Jaw not examined.

Lingual membrane of a Guadeloupe specimen (Pl. II. Fig. D, shows 3 marginals from 2 adjoining transverse rows), 23—1—23 teeth, with 4 perfect laterals. This lingual is peculiar in having its marginals bluntly bifid, as in *Nanina* and *Vitrina*. Some of the marginals are even trifid. In this respect it agrees with the dentition of *Vitrinoconus*, as does also *Z. fulvus*, but from that genus it differs in having its lateral teeth tricuspid like the centrals. Its dentition is altogether peculiar.

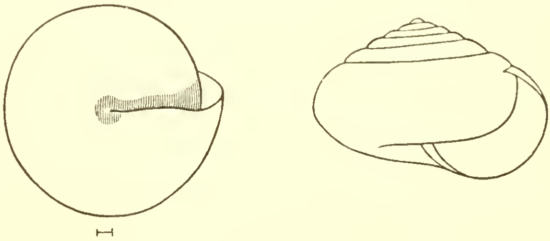
Genitalia not observed.

Zonites Stearnsi, Bland.

With land shells from the west coast, kindly sent to me for examination by my friend Mr. Stearns, I lately noticed a single specimen of a form from Astoria, Oregon, allied to *Microphysa Lansingi*. It is larger, more elevated, and more distinctly striated than that species, has 7 whorls, with rather wider and more rounded aperture, but without the lamella within the outer margin of the peristome. The measurements are, greater diameter 4, lesser 3½ mill.; height 2½ mill.

Having before me a single specimen, I am unwilling formally to describe the species, which for the present I designate as *Zonites Stearnsi* (Bland).

Fig. 46.



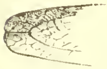
Zonites Stearnsi.

This is all the information I can give on this species. It is copied from Bland, Ann. of Lyc. of Nat. Hist. of N. Y., XI. 76, Fig. 3 (1875).

Subgenus GASTRODONTA, Albers.

Animal (of *Z. suppressus*) bluish-black, darker on the head, eye-peduncles, and neck; eye-peduncles long and filiform, tentacles short. Length twice the diameter of the shell. On the upper surface of the extremity of the foot is the mucus pore, a longitudinal fissure or furrow from which mucus exudes in great quantities, and which the animal shuts and closes at will. A distinct locomotive disk and longitudinal furrows above the margin of the foot.

Fig. 47.



Tail of *Zonites suppressus*, enlarged.

Shell subperforate or umbilicated, orbicularly depressed, light horn-color, sometimes glassy, with more or less numerous wrinkle-like striæ; whorls 5 – 7; aperture lunate, its base generally furnished with fold-like denticles not reaching its margin; peristome simple, acute.

Zonites gularis, Say.

Vol. III. Pl. XXXVII. Figs. 3, 4.

Shell subperforated, subconical; epidermis shining, pale yellowish horn-color; spire sometimes tending to a point, at other times obtuse; whorls 7 or 8, very minute at the apex, increasing in diameter regularly and gradually, until they reach the aperture, with strongly marked, curved wrinkles; suture impressed and distinct; aperture transverse, not much expanded; peristome simple, thin at its edge, within thickened with a white, testaceous deposit; base flat, indented in the centre, near the aperture yellowish-white and opaque; umbilicus small and rounded in young shells, obsolete or diminished to a mere point in older ones; within the base of the aperture are one or two lamelliform, elongated, nearly parallel teeth, one near the base, the other more central. Greater diameter, 8 mill.; height, 5 mill.

Helix gularis, Say, Journ. Acad. Nat. Sci. Philad., II. 156 (1822); Binney's ed. 18. — Binney, Bost. Journ. Nat. Hist., III. 408, Pl. XI. Fig. 1 (1840); Terr. Moll., II. 251, Pl. XXXVII. Figs. 3, 4. — DeKay, N. Y. Moll., 46 (1843). — Férussac, Hist., Pl. LI. a, Fig. 4 (?). — Pfeiffer, Mon. Hel. Viv., I. 183, excl. β; Symbolæ, II. 29. excl. β; in Chemnitz, ed. 2, II. 201, Tab. CI. Figs. 5-8. — W. G. Binney, Terr. Moll., IV. 122. — Mrs. Gray, Fig. Moll. An., Pl. CXCI. Fig. 4. ex Bost. Journ. — H. & A. Adams (*Gastrodonta*), Gen. Rec. Moll., Pl. LXXI. Fig. 4 (no descr.). — Reeve, Con. Icon., No. 719 (1852).

Helix bicostata, Pfeiffer, Mon. Hel. Viv., I. 182; Symbolæ, III. 697 (1852); in Chemnitz, ed. 2, II. 196, Pl. C. Figs. 21-23 (1846). — Reeve, l. c.

Gastrodonta gularis, Tryon, Am. Journ. Conch., II. 257 (1866).

Zonites gularis, W. G. Binney, L. & Fr.-W. Sh., I. 292 (1869).

A Post-pleiocene species. At present it seems to be restricted to the Cumberland Subregion. It ranges along the Appalachian chain into Pennsylvania, and southerly into Georgia and Alabama. In East Tennessee it appears to reach its greatest development.

Animal bluish-black on head and back, other parts dingy white; eye-peduncles long, slender, enlarged, but not much bulbous at tip; foot above, dirty greenish. A distinct locomotive disk; longitudinal furrows above the margin of the foot, meeting over a longitudinal mucus pore.

There is an umbilicated variety of the species.

The present species resembles some varieties of *Z. ligerus*, Say, in form and general appearance, although its size is much less. This remark, which was made by Say, in his original description, is entirely inapplicable to the specimens which are usually known as *Z. gularis*. It also resembles *Z. suppressus*, Say, the next described species, with which it has long been confounded. But it has at least one more whorl; the spire is much higher; the nucleus of the shell is smaller, so that the first two whorls are finer and more delicate; and the base is not so convex. The base of the shell is exceedingly like that of *Z. internus*.

It is the totality of the characters which makes up the species; for individuals differ considerably in the height of the spire, the size of the umbilicus, and in the degree of prominence of the teeth. One tooth is often wanting.

The deposition of testaceous matter, thickening the shell at its aperture, occupies about one fourth of the base, through which it is seen. The character of the lamellar folds, within the aperture, resembles those of *Sagda epistylium*, Müller, in which species they are large and prominent.

Jaw highly arcuate, ends attenuated, anterior surface smooth, cutting edge with a well-developed median projection.

The lingual membrane (Pl. III. Fig. K) has 30—1—30 teeth, with 10 perfect laterals.

The genitalia have the two accessory glands to the dart sac, as in *intertextus*, while *suppressus* has but one.

Zonites suppressus, Say.

Vol. III. Pl. XXXVII. Fig. 1.

Shell convex depressed, thin, pellucid; epidermis polished, yellowish horn-color; spire flat; whorls 6, with crowded, minute, oblique striæ; suture impressed, distinct; aperture transverse, not expanded; peristome simple, thin at its edge, thickened within; base rather convex, near the aperture opaque, yellowish-white; umbilicus small, but rounded and distinct in young shells, obsolete or hardly apparent in older ones; within the peristome are 1 or lamelliform, elongated, oblique teeth. Greater diameter 5, lesser 4 mill.; height, 2 mill.

Helix suppressa, Say, New Harm. Diss., II. 229 (1829); Descr. 14; Binney's ed. 36. — Binney, Bost. Journ. Nat. Hist., III. 410, Pl. XI. Fig. 3; Terr. Moll., II. 253, Pl. XXXVII. Fig. 1. — DeKay, N. Y. Moll., 38, Pl. III. Fig. 24 (1843). — Reeve, Con. Icon. 723. — W. G. Binney, Terr. Moll., IV. 122. — Morse, Amer. Nat., I. 411, Fig. 25 (1867). — Pfeiffer, Mon. Hel. Viv., IV. 153. — Leidy, anat. Terr. Moll., I. Pl. XII. Fig. VIII.

Helix gularis, var. β, Pfeiffer, in Chemnitz, ed. 2, etc. See *Z. gularis*.

Gastrodonta suppressa, Tryon, Am. Journ. Conch., II. 258 (1866).

Zonites suppressa, W. G. Binney, L. & Fr.-W. Sh., I. 293 (1869). — Gould and Binney, Invert. of Mass., ed. 2, 454 (1870).

I have considered this as a species of the Interior Region, which has passed those limits ranging into the Northern and Southern Regions. I have actually received it from New England to Florida and to Michigan.

Animal: see p. 94, and Bost. Journ. of Nat. Hist., III. Pl. XI. Fig. 3.

This shell does not correspond exactly with Say's description; but I think it is the same that he described under this name. Having received, from different localities, suites of them, of different sizes, I notice that the "umbilicus small, orbicular, profound," of Say, exists only in young specimens, it being closed in the full-grown shell.

It resembles the preceding species, but has one whorl less, is more depressed, and its base is more convex. The tooth in the aperture is sometimes so little prominent as to be hardly visible; at other times there are 3 teeth. The striæ of growth are fine and crowded, and seem to be more nearly at right angles with the suture than is usual in other species.

Jaw strongly arcuate, ends rounded; concave margin smooth, with a stout, rounded, blunt, median projection.

Z. suppressus (Pl. III. Fig. J, the marginals are from near the edge of the membrane) has 30—1—30 teeth, with 8 perfect laterals on its lingual membrane.

The genitalia are figured by Leidy (l. c.) as in *Z. intertextus* (see above). I have already under *Z. gularis* pointed out the specific distinction between that species and *suppressus*, furnished by the genital system.

Zonites lasmodon, PHILLIPS.

Vol. III. Pl. XXXVII. Fig. 2.

Shell very much flattened above, a little convex; epidermis corneous, shining; whorls 7, narrow, very slowly increasing in diameter from the apex to the aperture, and not expanding at the aperture, with minute, transverse striæ and wrinkles; suture moderately impressed; peristome thin, acute; aperture nearly circular; within, upon the base, are 2 prominent, white, testaceous laminæ, nearly parallel, and extending far into the cavity of the whorl; umbilicus large, rather expanded, and deep; base smooth, well rounded from the umbilicus to the circumference. Greatest diameter, 6 mill.; height, 2½ mill.

Helix lasmodon,[1] PHILLIPS, Journ. Acad. Nat. Sci., VIII. 182 (1842); Proc. of same, I. 28 (1841). — BINNEY, Terr. Moll., II. 254, Pl. XXXVII. Fig. 2. — DEKAY, N. Y. Moll., 47 (1843). — PFEIFFER, Mon. Hel. Viv., III. 142, V. 216 (1868). — W. G. BINNEY, Terr. Moll., IV. 122.

Helix macilenta, SHUTTLEWORTH, Bern. Mit. 1852, 195. — GOULD, Terr. Moll., III. 20. — PFEIFFER, l. c. III. 640.

Gastrodonta lasmodon, TRYON, Am. Journ. Conch., II. 257 (1866).

Hyalina lasmodon, W. G. BINNEY, L. & Fr.-W. Sh., I.

A species of the Cumberland Subregion, found thus far only in Eastern Tennessee and in the mountains of Northern Alabama.

Animal with the distinct locomotive disk, the longitudinal furrows above the margin of the foot, and the caudal mucus pore characterizing *Zonites*.

Jaw and lingual as usual in the genus.

The lingual membrane (Pl. III. Fig. O) has 41—1—41 teeth, with 9 perfect laterals. The reflected portion of the centrals and laterals is short, as in *Vitrina*.

Genitalia not observed.

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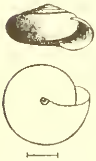
[1] Should not the name be rather *elasmodon*?

Zonites significans, Bland.

Shell umbilicate, depressed, discoidal, thin, with fine irregular striæ, which are almost obsolete at the base, shining, pale horn-colored; spire little elevated; suture slightly impressed; whorls 6, subplanulate, the last roundly inflated, rather flat at the base, excavated around the umbilicus, which is pervious, and equal almost to one fifth of the diameter of the shell; aperture oblique, depressed, lunate; peristome simple, acute. Greater diameter $4\frac{1}{2}$, lesser 4 mill.; height, 2 mill.

Fig. 48.



[*Z. significans.*

Helix significans, Bland, Am. Journ. Conch., II. No. 4, p. 372, Pl. XXI. Fig. 9 (1866).

Gastrodonta significans, Tryon, Am. Journ. Conch., II. 163 (1866).

Hyalina significans, W. G. Binney, L. & Fr.-W. Sh., I. (1869).

Fort Gibson, Indian Territory; Union County, Tennessee. I consider it a species of the Cumberland Subregion, with the western range shared by many of the species of the subregion.

In a young specimen of *significans*, having 4 whorls only, there are 3 small teeth, one by itself, and at some distance from it 2 others, situated as the teeth are in *multidentata*. Whether these teeth are or not constant in the antepenultimate whorl of *significans*, I am unable to determine. It is especially allied to *Z. multidentatus*, from which it differs in being of larger size with wider umbilicus (Bland).

Jaw not observed.

Lingual membrane (Pl. III. Fig. R); 16—1—16 teeth, with 2 perfect laterals.

Genitalia not observed.

Zonites internus, Say.

Vol. III. Pl. XXX. Fig. 4.

Shell very narrowly perforated, depressed, slightly convex; epidermis reddish-brown, shining; whorls 8, with regular, equidistant, elevated, oblique, rounded ribs, separated by distinct grooves; suture deeply impressed; aperture flattened, transverse, narrow; peristome thin, acute, thickened internally; within the base of the aperture, somewhat distant from the margin, are 2 prominent, sub-lamelliform, white teeth, not reaching the edge of the peristome; base smooth, polished, umbilical region indented. Greater diameter, $5\frac{1}{2}$ mill.: height, $3\frac{1}{2}$ mill.

Helix interna, Say, Journ. Acad., II. 155 (1822); Binney's ed. 18. — Binney, Bost. Journ. Nat. Hist., III. 405, Pl. XXI. Fig. 1 (1840); Terr. Moll., II. 247, Pl. XXX. Fig. 4. — DeKay, N. Y. Moll. 46 (1843). — Chemnitz, 2d ed., I. 200, Tab. CI. Figs. 1–4. — Pfeiffer, Mon. Hel. Viv., I. 183. — Reeve, Con. Icon. 718. — W. G. Binney, Terr. Moll., IV. 121.

Helix pomum-adami, Green, Doughty's Cab., III. 35 (1834).

Gastrodonta interna, Tryon, Am. Journ. Conch., II. 258 (1866).

Hyalina interna, W. G. Binney, L. & Fr.-W. Sh., I. 49, Fig. 79 (1869).

A species of the Interior Region, traced thus far from the Alleghany Mountains to Missouri; Ohio to Georgia.

The teeth within the aperture are in general formed of a single prominent lamina, or tooth-like fold; but sometimes one or both of them are bifid, or even trifid. A second set often, and sometimes a third set, of teeth are seen through the transparent base of the shell, irregularly striated, but generally having equal spaces between each two sets. They are apparent in the youngest as well as in the oldest specimens, and continue to be formed from time to time, so long as the shell increases in size. They probably mark regular periods of growth; and it may be that these are annual. The growth seems to go on actively for a time, by the addition of new testaceous matter, indicated by the oblique striæ, and then alternates with a season of repose, when the teeth and aperture are formed. The teeth appear never to be entirely absorbed and removed, although the aperture, near which they were originally placed, is often advanced very far beyond them. When in motion, the shell lies horizontally on the animal's back.

A curious subject of investigation is the albinism, or entire absence of coloring matter, in the shells of certain individuals of this and other species. The albinos of this species are of a pure, lively white, while the contained animal is highly colored. Mr. Anthony remarks that about one seventh of all the specimens collected by him in the neighborhood of Cincinnati are colorless. As they are apparently operated upon by the same physical agents which influence the others, it is not easy to conjecture how this singular effect is produced. The animal is sometimes cream-colored throughout; but in such instances the shell is usually colored.

Animal with head, neck, and eye-peduncles bluish-black or slate-color; margin and posterior part of foot white. Eye-peduncles very long, tentacles very short; body narrow and delicate, in length not much exceeding the diameter of the shell. I cannot detect any caudal mucus pore, but it is difficult to see any such, even if existing (as I believe it must), on account of the extreme transparency of the animal.

Jaw slightly arcuate, ends attenuated, pointed; a median, beak-like projection to the cutting edge.

Lingual membrane as usual in *Zonites* (Pl. III. Fig. Q) with 28—1—28 teeth; 4 laterals.

The genital system has the dart sac and dart of *ligerus*.

Zonites multidentatus, BINNEY.

Vol. III. Pl. XLVIII. Fig. 3.

Shell umbilicated, depressed, sub-planulate above, very thin, pellucid; epidermis smooth, shining; whorls 6, narrow, slightly convex, increasing but slowly in diameter, delicately striated, beneath smoother; suture impressed;

aperture semi-lunate, narrow; peristome acute; umbilicus very small, rounded, pervious; base convex, indented around the umbilicus; two or more rows of very minute, white teeth, radiating from the umbilicus, are seen through the shell, within the base of the last whorl. Greater diameter $3\frac{1}{4}$, lesser 3 mill.; height, $1\frac{1}{2}$ mill.

Helix multidentata, BINNEY, Bost. Journ. Nat. Hist., III. 425, Pl. XXII. Fig. 5 (1840); Terr. Moll., II. 258, Pl. XLVIII. Fig. 3. — ADAMS, Vermont Mollusca, 161 (1842). — CHEMNITZ, 2d ed., II. 201, Pl. CI. Figs. 9-12. — PFEIFFER, Mon. Hel. Viv., I. 184. — W. G. BINNEY, Terr. Moll., IV. 123. — REEVE, Con. Icon., No. 729. — MORSE, Amer. Nat., I. 543, Fig. 33 (1867).

Hyalina multidentata, MORSE, Journ. Portl. Soc., I. 15, Fig. 31, p. 61, Fig. 30; Pl. VI. Fig. 32 (1864). — W. G. BINNEY, L. & Fr.-W. Sh., I. 50, Fig. 80 (1869). — GOULD and BINNEY, Inv. of Mass., ed. 2, p. 404 (1870).

Gastrodonta multidentata, TRYON, Am. Journ. Conch., II. 258 (1866).

A species of the Northern Region, noticed in Maine, Vermont, New York, Ohio; also Lower Canada.

For a figure of the rosy-white, thread-like animal, see Boston Journ. Nat. Hist., III. Pl. XXII. Fig. 5.

This species possesses characters so marked that it, at first, is not likely to be mistaken for any other. The numerous narrow whorls visible on its upper and plane surface, while only one is seen below, together with its minute, round umbilicus, and narrow aperture, would sufficiently distinguish it; but there is another still more peculiar character. There are from 2 to 4 rows of very minute, delicate white teeth, on the lower side of the interior of the last whorl, radiating from the centre. One row is usually so near the aperture as to be seen within it with the aid of a microscope; the others are more or less remote; each row contains from 5 to 6 distinct teeth. They are visible through the shell. The transparency of the shell is so great that frequently the sutures of the upper surface can be seen through it, when viewed on the base. With the living animal within, the shell has a roseate tinge.

Jaw arcuate, broad in centre, greatly attenuated and blunt at ends; concave margin smooth, with a slight median projection.

The lingual membrane examined (Pl. III. Fig. N) had 14—1—14 teeth, with 2 perfect laterals. Morse gives 68 rows with 15—1—15 teeth, also 2 perfect laterals.

FOSSIL SPECIES OF ZONITES.

Zonites (Conulus) priscus, CARPENTER, Quart. Journ. Geol. Soc., 1867, p. 331, with Figs. Nova Scotia.

Helix (Zonites) marginicola, CONRAD, Am. Journ. Conch., VI. 315, Pl. XIII. Fig. 9, 1871. Oregon Terr.

DOUBTFUL SPECIES OF ZONITES.

Zonites cultellatus (see Vol. IV. p. 22, pl. lxxvi. Fig. 6). This species must be removed from our catalogue, not having again been found in and most probably not belonging to our limits.

Zonites Newberryana, Vol. IV. p. 20, is a species of the *Helicea* now described as a new genus *Glyptostoma*, q. v.

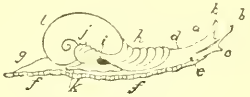
Zonites alliarius has been found in hot-houses in Brooklyn, N. Y., and Chicago. It is said by Mörch to be found in Greenland (Amer. Journ. Conch., IV. 29).

Zonites Lansingi. See *Microphysa*.

VITRINA, DRAP.

Animal heliciform, obtuse before, pointed behind. Mantle posterior, with an anterior prolongation covering the back, and with a process or prolongation which is reflected backward upon the shell. A distinct locomotive disk. No caudal mucus pore. Respiratory orifice (*i*) subcentral, on the right edge of the mantle, under the peristome of the shell. Generative orifice (*e*) somewhat in the rear of the right eye-peduncle. Anal orifice contiguous to the respiratory orifice.

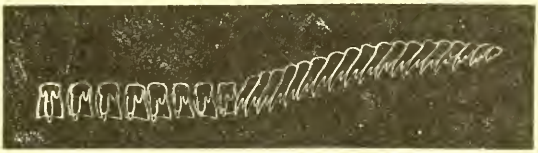
Fig. 49.



Animal of *Vitrina*.[1]

Shell external, imperforate, pellucid, glassy, depressed. Spire short, whorls 2 – 3, rapidly increasing, the last wide; aperture large; peristome thin, often membranous.

Fig. 50.



Lingual dentition of *V. limpida* (MORSE).

The jaw is highly arched, ends acuminated, blunt; anterior surface smooth cutting margin with a prominent beak-like median projection. I have figured; the jaw of *V. limpida* on Pl. XVI. Fig. II. I have found it to be the same in *V. exilis* and *Pfeifferi*. I have not examined either jaw or lingual membrane in *V. Angelicæ*.

Fig. 50 gives a general idea of the lingual membrane. The centrals have a quadrangular base of attachment, longer than broad. The reflection is short, with three distinct cusps, the median long and slender, bulging at the sides, the outer ones very short; all the cusps bear cutting points in proportion to their length. The lateral teeth are arranged in straight transverse rows. They are like the centrals, but unsymmetrical by the partial suppression of the inner side cusp and inner lower lateral expansion of the base of attachment, and the complete suppression of the cutting point to the inner side cusp. The marginals have a sole-shaped base of attachment, and truly aculeate cutting points, which, however, are bluntly bifid at their points. The marginals are in oblique, curving rows, gradually decreasing in size of the teeth as they pass off laterally. They do not first increase and then decrease, as in *Zonites* and *Glandina*, or not, at all events, to the same degree. In *V. limpida*, as stated below, the seventh marginal appears, however, to be the largest.

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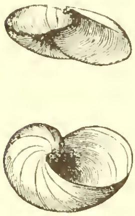
[1] From Moquin-Tandon.

Vitrina has a world-wide distribution. In North America it is restricted almost exclusively to the Northern Region, excepting on high elevations.

Vitrina latissima, Lewis.

Fig. 51.



V. latissima.

Shell vitrinaform, very much depressed, thin, fragile, translucent, polished; suture deeply impressed; whorls 2, very rapidly expanded, with delicate lines of growth and quite conspicuous, separated, deeply impressed, arcuate, transverse lines, and crossed by a few, microscopic, impressed, revolving lines; aperture nearly equal to half the area of the base of the shell, very oblique, unsymmetrically ovate; peristome thin and acute, flexuose above and at the columellar origin arising from the axis of the shell; axis imperforate; color of the shell amber brown. Transverse diameter, 17.3 mill.; lesser diameter, 11.9 mill; height, 7.1 mill.

Tennessee Bald Mountain, 6,600 feet. A species of the Cumberland Subregion.

Vitrina latissima, Lewis, Proc. Acad. Nat. Sc. of Phila. 1875, 336, Pl. XXIII. Fig. 7.

Fig. 51 is drawn from the original specimen. I regret not having had an opportunity of seeing the animal, to verify its generic position.

Vitrina limpida, Gould.

Vol. III. Pl. LXVII. a, Fig. 1.

Shell globose-discoid, thin, fragile, transparent, shining; whorls $2\frac{1}{2}$ to 3, scarcely convex, with very minute lines of increase, the last whorl large and much expanded; suture not much impressed, sometimes with an impressed line revolving near it; aperture large, subovate, somewhat diminished by the intrusion of the penultimate whorl; peristome thin and acute, the columellar margin a little reflected; axis imperforate. Greatest transverse diameter nearly 6 mill.

Vitrina pellucida, DeKay, N. Y. Moll., 25, Pl. III. Fig. 42 (1843), not of Müller. — Adams, Sh. of Vt., 162. — Binney, T. M., II. 58, Pl. LXVII. a, Fig. 1.

Vitrina Americana, PFEIFFER, Dec. 1852, Proc. Zoöl. Soc., 156. — CHEMNITZ, ed. 2, 9, Pl. I. Figs. 22-25 (1854).

Vitrina limpida, GOULD, in AGASSIZ' Lake Superior, p. 243, 1850; Terr. Moll., l. c. — PFEIFFER, Malak. Blätt., II. 10 (1856); Mon. Hel. Viv., IV. 798. — W. G. BINNEY, T. M., 33. — REEVE, Con. Icon., 62. — MORSE, Journ. Portl. Soc., I. 11, Pl. V. Fig. 17 (1864); in Amer. Nat., I. 314, Fig 20 (1867). — TRYON, Am. Journ. Conch., II. 243 (1866). — W. G. BINNEY, L. & Fr.-W. Sh., I. 27 (1869). — GOULD and BINNEY, Invert. of Mass., ed. 2, 394 (1870).

Found in Maine, Vermont, New Brunswick, and to the northwest of Lake Superior, and at Troy, Utica, Mohawk, and Palmyra, N. Y. The species may be said to belong to the Northern Region.

Animal whitish, grayish, or blackish, large compared with the shell. Head, eye-peduncles, and eyes black; tentacles very short. The prolongation of the mantle extends from under the shell, over the back and neck to the base of the eye-peduncles, but is unattached and free; from the right side of the mantle posteriorly there arises a tongue-shaped process, which is reflected back upon the shell, and reaches to the spire. Respiratory foramen in the posterior part of the mantle, taken with its prolongation.

In *V. limpida* I have counted 71 rows of 30—1—30 teeth, with 9 perfect laterals. The seventh marginal is the largest. Another gave 39—1—39, with 10 perfect laterals. The membrane figured by Morse had 30 rows of 25—1—25 teeth, with 9 laterals. I have figured of this species, on Pl. II. Fig. C, one central and its adjacent lateral, and the twenty-third tooth. The marginals increase in size up to the seventh, then gradually decrease.

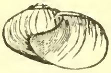
In color the shell varies from almost white to dark horn.

Should the species prove identical with the European *pellucida*, as formerly believed, it must be considered a circumpolar species. The complete anatomy of *pellucida* is given by Lehmann (Lebenden Schnecken, 47, Pl. IX. Fig. 12). His count of the teeth, 103 rows of 37—1—37 teeth, does not agree with our species as to number of transverse rows, but that may be far from indicating specific difference.

Vitrina Angelicæ, BECK.

Shell convexly depressed, smooth, polished, pellucid, greenish-yellow; spire short, subprominent; suture delicately crenulated; whorls 3½, rapidly increasing, the last broad below; aperture oblique, lunate-oval; peristome simple, subinflected, its columellar margin not receding and slightly arched. Greatest diameter 6, lesser 4⅔ mill.; height, 3½ mill.

Fig. 52.



V. Angelicæ, enlarged.

Vitrina Angelicæ, BECK, Ind. 1. — MÖLLER, Ind. Moll. Gr., 4 (1842). — PFEIFFER, Mon. Hel. Viv., II. 510. — MÖRCH, Nat. Bidr. af Gr., 76. — W. G. BINNEY, T. M. U. S., IV. 32, Pl. LXXIX. Fig. 9. — REEVE, Con. Icon., 45. — TRYON, Am. Journ. Conch., II. 243 (1866). —

Mörch, Am. Journ. Conch., IV. 27, Pl. III. Figs. 1, 4 (1868). — W. G. Binney, L. & Fr.-W. Sh., I. 28 (1869).

Helix pellucida, Fabricius, Fauna Gr., 389, excl. syn. Müller (1780).

Helix domestica, Ström.[1] Der Tronh. Vidensk., III. 435, Pl. VI. Fig. 15.

Godhavn, Greenland, on *Archangelica officinalis*.

My figure is from a typical specimen in the British Museum. For other figures and much information regarding the species, see Mörch, l. c.

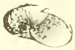
Animal bluish-gray, head black; mantle edge bluish-gray, densely speckled with black; hinder part of foot pale gray. The lobe of the mantle very small, by which latter character and the smaller number of whorls it is distinguished from *pellucida*. (Müller in Mörch, l. c.)

I have seen no specimen of the species.

Vitrina Pfeifferi, Newcomb.

Shell moderately depressed, smooth, shining, pellucid, greenish-white; whorls 3, the last composing most of the shell; suture very finely margined; aperture large, obliquely and roundedly ovate; lip thin, columella arched. Diameter, 5 mill.; axis, 2 mill. (Newcomb.)

Fig. 53.



V. Pfeifferi, enlarged.

Vitrina Pfeifferi, Newcomb, Proc. Cal. Acad. Nat. Sci., II. 92 (1861). — Tryon, Am. Journ. Conch., II. 244, Pl. III. Fig. 3 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 28, Fig. 26 (1869).

I have traced this species over all of California as far south as Fresno County; in Nevada, Colorado, at St. George, Utah, at Fort Wingate, New Mexico. It may therefore be said to inhabit both the California Province and the Central Region. It is, as usual in the genus, found at high elevations.

Like *V. limpida* it is variable in color.

Jaw as usual in the genus.

The lingual membrane has over 50—1—50 teeth, with 10 perfect laterals. I figure a central and lateral (Pl. II. Fig. A), and one extreme marginal.

Vitrina exilis, Morelet.

Shell subperforate, rather convex-depressed, very thin, pellucid, hyaline, very lightly and distantly striate; suture impressed, margined; whorls 3, rapidly increasing, the last broad below, flattened; aperture obliquely oval, the termination of the peristome membranous, that of the columella slightly reflected, giving the impression of a punctiform perforation. Greater diameter 7½, lesser 5 mill.; height, 3 mill.

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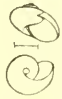
[1] This name I give to a little snail, which is represented by Fig. 15, since I find nothing in Linné's Systema Nat. to which I can with certainty refer it. It is small, ovate-rounded, and somewhat convex above, and shows 3 small and flat whorls on the one side. The aperture is large and may be called almost entirely round, and the columella, or part attached to the snail's house, comprises a small segment, or may be inscribed in an exact circle. The shell is yellowish, and so brittle that one cannot pick it up without breaking it in pieces. It contains a bluish snail. It is found in great numbers under the moss or turf on houses, and is sometimes fully as large as the figure, which represents both the upper and lower sides. (Ström.)

Allied to *V. pellucida*, but with less broad spire and differing in the perforation. (Morelet.)

Fig. 54.



V. exilis.

Vitrina exilis, Morelet, Journ. de Conch., VII. 8. — Pfeiffer, Mon. Hel. Viv., IV. 799 (1859).

A Kamtschatka species. Petropaulauski (Dall), Ounalaska (Cooper, as *pellucida?* Am. Journ. Conch., V. 200).

Jaw and lingual membrane as usual in the genus, the former with ends somewhat recurved as in *Zonites arboreus*.

Vitrina exilis has about 37—1—37 teeth on its lingual membrane, with 7 perfect laterals. I have given on Pl. II. Fig. B, one central, lateral, and marginal.

Fossil Species of Vitrina.

Vitrina obliqua, Meek & Hayden, Proc. Phila. Acad. Nat. Sci. 1857, 134.

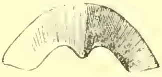
LIMAX, Linn.

Body subcylindrical, lessening towards the posterior extremity, which terminates in a point. Back with a carina or keel when contracted, convex when extended. Integuments with longitudinal elongated glands, and anastomosing furrows arranged in the same manner upon both sides. Mantle small, anterior, oval, marked with fine concentric striæ or prominent wrinkles, unattached and free at the front and sides, but connected with the body at its posterior part, and containing in this part a testaceous rudiment or shell. Base of foot not expanded at margin, having a narrow locomotive disk running longitudinally along its centre and separated from the sides by a well-defined line or furrow. Respiratory orifice near the right posterior margin of the mantle, large. Anal orifice immediately adjacent to, but a little below and anterior to the respiratory orifice, with a cleft or fissure through the mantle from the orifice to its edge. Orifice of organs of generation near, and immediately behind, the right eye-peduncle (Vol. III. Pl. LXV.).

Testaceous rudiment thin, concentrical, not spiral, covered above with a thin and transparent periostraca, below smooth.

Jaw arcuate, with slightly attenuated but blunt ends; anterior surface smooth, cutting margin with a decided beak-like median projection. There is often a central vertical carina to the jaw. The ends are often more pointed than in the jaw figured. I have examined the jaw of all our species.

Fig. 55.

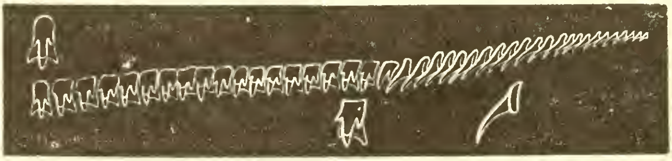


Jaw of *Limax*.

The dentition of *Limax* is nearly allied to that of *Zonites*. The lateral teeth are arranged in straight transverse rows, the marginals in oblique rows, as aculeate marginal teeth always are. This tendency to obliquity in the rows of aculeate teeth we have seen most plainly shown in *Glandina*. To show the general arrangement of the teeth in straight and oblique rows I repeat the figure by Morse in "Land and Fresh-Water Shells, N. A." I., which was probably drawn from *L. agrestis*. It must be borne in mind that this figure is not intended to show the characters of the separate teeth, for which I refer to my plate.

The genus *Limax* differs from *Zonites* in its dentition by having more slender, spine-like marginals, instead of the short, strictly aculeate form. The base of attachment of the marginals in *Limax* is also different, being less sole-like and more irregularly circular on the extreme marginals. Another difference is that the marginal teeth do not increase in size so rapidly, and then decrease gradually as they pass off laterally, thus giving an irregularly crescentic form to each half of every transverse row. In *L. maximus* the marginal teeth decrease gradually in size from the first to the last. It is the same with *agrestis*, but I believe the character is not generic, as *L. montanus* differs in this respect.

Fig 56.



Lingual Dentition of *Limax*.

It will be seen that even in the few species existing in North America there is considerable variation in the lingual dentition, especially in the bifurcation or non-bifurcation of the marginal teeth, the development of the side cusps to the central and lateral teeth, and the presence or absence of distinct cutting points to these cusps. I shall, however, simply describe the dentition of our species, without reference to the subgeneric or generic value of these differences of dentition, or of the peculiarities of the mantle on which also generic and subgeneric distinctions have been founded.

Species of *Limax* have been found in every quarter of the globe, but they may be said to belong rather to the more temperate regions. In North America they are less common in the tertiary portions of the Southern States, but are found abundantly in the Middle and Northern States and in the British Possessions. Specimens were collected by Mr. Kennicott as far north as the junction of the Yukon and Porcupine Rivers in Russian America. The Pacific States also are inhabited by several species. I have received one from Lower California. The genus is also found in the Central Province. The cellars and gardens of the cities of the Atlantic seaboard are infested with several European species, introduced by commerce. Like rats and mice, and various destructive insects which have proceeded from continent to continent and from island to island in the same manner, they occupy the houses and other structures, in the immediate vicinity of man, preying upon the fruits of his industry, and consuming his stores of provisions. Like them they thrive only in the vicinity of, and, as it were, in contact with man, and never withdraw from him to resume their original manner of living in the wilds. These habits are the cause of much mischief, and when the animals are numerous, render them the pests of the house and the garden. Their increase, therefore, beyond a certain point becomes prejudicial, and means are adopted to keep them in check. In various ways thousands of them are destroyed during the year, but their extraordinary fertility enables them to make the loss good and to sustain themselves in undiminished numbers.

Species of the genus found in this country can be readily confounded only with those of the genus *Arion*. They can be at once distinguished by their smooth jaw with its rostriform projection, that of *Arion* being ribbed and regularly concave below; the respiratory orifice of *Limax* is on the hinder part of the shield, while in *Arion* it is on the anterior portion; the rudimentary shell of *Limax* is strong, oblong or square, while in *Arion* there are but irregular grains of calcareous matter.

It will be noticed that the genitalia furnish reliable specific characters in the *Limaces* found within our limits. The variation shown in the shell of the heliciform genera seems here to be transferred to these organs. It seems to be a generic character that the testicle is composed of aciniform cœca, and is not imbedded within one of the lobes of the liver.

As some confusion exists in regard to the specimens furnishing the descriptions and figures of dentition published in this country, I have taken pains to be sure of the specific identity of each specimen from which my own are drawn.

The *L. maximus* was collected in Newport, R. I., by my friend, Mr. Samuel Powel. It is the same individual figured on p. 408 of my edition of Gould's "Invertebrata of Massachusetts." The external markings of the animal are conclusive proofs of its identity with the European species. I have, however, made it still more certain by examining the genitalia, which I find agree with those of *L. maximus*, figured by Lehmann (Lebenden Schnecken, etc.). I find the dentition agrees also with the figures given by Heynemann (Malak. Blätt. X.), Lehmann (l. c.), and Goldfuss (Verhl. Naturh. Vereins der Preuss. Rheinl., etc.).

The *L. flavus* was collected in a cellar in Burlington, N. J. It not only agrees with the figure in the "Terrestrial Mollusks" as far as its outward markings are concerned, but I find also its genitalia to agree with Dr. Leidy's figure in the same work, and also with the figure given by Moquin-Tandon (Moll. Fr.). Its dentition agrees with the figures of Heynemann and Semper (Arch. Phil.).

The *L. agrestis* was collected in a garden in Burlington, N. J. This species I have also found to agree with the figures of the external animal and genitalia given in the "Terrestrial Mollusks," as well as with Moquin-Tandon's (Moll. Terr. et Fluv. de la France) figure of the genitalia, and Heynemann's and Lehmann's figure of the dentition; also with the figure of the genitalia given by Schmidt and Lehmann.

The *Limax campestris* examined was collected in the country near Burlington, N. J., by my friend, A. Ten Eyck Lansing. It agrees with the description and figures in the "Terrestrial Mollusks," not only as to its external characters, but in its genitalia. I will here mention that its dentition does not agree with that of *L. Weinlandi*, Heynemann (l. c. p. 212), supposed by that author to be the same species.

The *Limax Hewstoni* examined is a typical specimen, given by Dr. J. G. Cooper to the State Collection of California. It was labelled by him. There can be no doubt, therefore, of its identity.

The *Limax montanus* examined was one of the original lot found by Mr. Ingersoll, and furnished by him.

The *Limax occidentalis* was received from Dr. Cooper.

This completes the list of North American *Limaces* now known. I will add that *maximus* and *flavus* are put by Heynemann in the s. g. *Heynemannia; agrestis* in s. g. *Agriolimax; campestris* would be placed by him in s. g. *Malacolimax;* while *Hewstoni* would be placed by him in the genus *Amalia.*

The testicle in the genus is a round or oval body, partially concealed by the liver; it is brown in color, and has the appearance of being composed of rounded acini. In *L. flavus* it is lobulated. The epididymis is an undulated or moderately tortuous tube, leading from the testicle to the inner side of the junction of the ovary with the prostate gland. It opens into a groove upon the inner side of the interior of the oviduct, which is continuous, at its inferior extremity, with the vas deferens. Opening into the termination of the epididymis, and lying against the inner side of the ovary, is a small, compound, follicular body, which appears to be common to all the terrestrial Gasteropoda. The prostate gland is a white or cream-colored body, occupying the inner side of the whole length of the oviduct. It has a transverse, striated appearance, and numerous openings into the groove leading from the epididymis to the vas deferens.

The vas deferens is a comparatively short tube, passing from the prostate gland to the penis. In *L. flavus, montanus, Hewstoni,* and *maximus,* it joins the summit of the latter; in *L. agrestis* and *L. campestris* it enters near the base.

The penis, in *L. flavus,* is a long, cylindroid, irregular body, lying at the right anterior part of the visceral cavity, and joining at its termination a short cloaca. Into its summit is inserted the retractor muscle, which has its origin from the muscular investment of the visceral cavity, just posterior to the position of the pulmonary cavity. The interior of the penis is lined by mucous membrane, its exterior of muscular membrane. In *L. agrestis* and *L. campes-*

tris the organ which corresponds to the penis of *L. flavus* becomes of a somewhat problematical character. In *L. agrestis* it is an elongated conical organ, with a protuberant base. Its summit is divided into three cœca; the retractor muscle is inserted into its side. Upon the interior it presents several longitudinal folds of mucous membrane, and at its lower part, corresponding to the protuberance of the base, an oval, pointed papilla. In *L. campestris*, the organ is spiral, and has but a single pointed summit.

The ovary is a large, white, semi-elliptic organ, usually more or less curved and lobulated, and situated at the summit of the oviduct. In *L. agrestis* and *L. campestris* it is always two-lobed, or double. The oviduct is a long, wide, soft, white, tortuous, sacculated tube, passing from the ovary to the vagina. The neck or portion immediately joining the vagina commences usually where the prostate gland terminates, and is contracted to less than half the calibre of the upper portion of the tube. Its interior surface exhibits a number of transverse folds, corresponding to the contractions which produce the sacculated appearance of the organ, and upon the inner side upon each side of the spermatic groove, or longitudinal fold.

The generative bladder, in *L. flavus*, is a large, pointed, oval receptacle opening by a very short, wide tube or duct, into the vagina. In *L. agrestis* it is large, elongated oval, and opens by a short duct into the angle formed by the junction of the vagina with the male portion of the generative apparatus. In *L. campestris* it is a small oval sac, with a longer, narrow duct, opening into the tube leading from the penis to the cloaca. In all three species of *Limax* the cloaca is a short canal opening at the generative orifice on the right side of the head.

The characters of the various organs in the other species are given below.

Limax maximus.

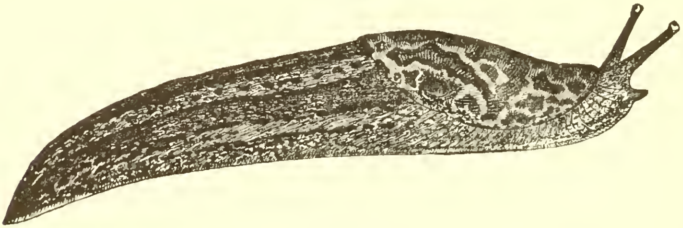
Color light brown or ashen with alternate longitudinal rows of round spots, and uninterrupted stripes of black along the back and sides, replaced by irregular blotches on the mantle; lighter on the sides, dirty white below; eye-peduncles and tentacles short, blackish. Body elongated, terminating in a well-marked dorsal carina; covered with coarse, elongated, longitudinal tubercles; constantly exuding mucus from its whole surface, giving a vermicular, glistening effect. Mantle large, bluntly oval, with tuberosities more delicate and arranged concentrically; orifice of respiration very large at its hinder lateral portion. Foot with a narrow locomotive disk. Length about 4 inches.

Limax maximus, LIN. Syst. Nat. Sci. — GOULD and BINNEY, Invert. of Mass. ed. 2, p. 408, Fig. 669 (1870). — TRYON, Am. Journ. Conch., III. 315, Pl. XVI. p. 2 (1867).

Limax antiquorum, FÉRUSSAC, Podr., 20; Hist., 68, Pl. 4, Pl. 8, A, Fig. 1.

A specimen of this common European slug was found in Newport, R. I., in a garden, by Mr. Samuel Powel (1868). It is figured below. This species has also been recently noticed in Philadelphia, and in Brooklyn, N Y. It is an introduced species. Its rich brown or black stripes, giving it a leopard-like appearance, and its great size, at once distinguish it from any species hitherto known to inhabit Eastern North America.

Fig. 57.



L. maximus.

Jaw long, narrow, arcuate, strongly striated both vertically and transversely, ends attenuated; cutting edge with a prominent median projection. There is a strong line of reinforcement running parallel to the upper margin, and a decided vertical median carina.

The lingual membrane (Pl. I. Fig. F) has about 76—1—76 teeth. The centrals have a large, subquadrate base of attachment. The reflection is large, subquadrate, and bears a single stout median cusp, which has a short cutting point, often longer than in the teeth figured; the side cusps are subobsolete, and bear no cutting points. The lateral teeth, about 18 in number, are like the centrals, but asymmetrical. The marginal teeth are aculeate. Only a few are simple, as in Fig. *b*; the balance are bifid, as in Fig. *c*. The bifurcation of the marginals in my specimens commences much nearer the median line than in the specimens examined by Lehmann and Heynemann. There are, indeed, but 12 marginals without the bifurcation on one membrane examined.

Individuals kept in confinement were guilty of cannibalism.

The eggs are globular, transparent, over two hundred in number, laid in a compact mass.

Genitalia (Pl. XII. Fig. A) with a strongly lobulated ovary; penis sac long, cylindrical, tapering to its apex, where it receives the retractor muscle and the vas deferens; genital bladder small, on a short duct.

Limax flavus, Linn.

Vol. III. Pl. LXV. Fig. 1.

Color brownish, yellowish-brown, or ashy brown, with oblong-oval uncolored spots, which have a longitudinal disposition; mantle with rounded spots; head, neck, and eye-peduncles blue, semi-transparent; tentacles white; base of foot sallow white. Body when extended cylindrical, elongated, terminating acutely with a short but prominent keel; upper part covered with long and narrow prominent tubercles. Mantle ample, oval, rounded at both ends, with numerous very fine concentrical striæ. Sides paler, and without spots. Respiratory foramen large, placed near the posterior lateral margin of the mantle and cleft to the edge. Generative orifice indicated by a white spot a little behind the eye-peduncle of the right side. Length, when fully extended, usually about 75 mill.; an individual kept in confinement with abundance of food attained the length of nearly 125 mill., and several others that of 200 mill.

Limax flavus, LINNÆUS, Syst. Nat. [x.], 1758, I. p. 652 (not MÜLLER, 1774). — BINNEY, Bost. Journ. Nat. Hist., IV. 164 (1842). — DEKAY, N. Y. Moll., 21, Pl. I. Fig. 5 (1843). — GRAY and PFEIFFER, REEVE, etc. — TRYON, Am. Journ. Conch., III. 314 (1868). — W. G. BINNEY, L. & Fr.-W. Sh., I. 61 (1869). — GOULD and BINNEY, Invert. of Mass., ed. 2, 410 (1870).

Limax variegatus, DRAPARNAUD, Tabl. Moll. 103 (1801). — FÉRUSSAC, MOQUIN-TANDON. — BINNEY, Terr. Moll., II. 34, Pl. LXV. Fig. 1 (1851). — LEIDY, anat., T. M., I. 248, Pl. I. (1851).

An introduced species, noticed hitherto in Massachusetts at Boston and Cambridge; in the cities of New York, Philadelphia, and Baltimore; in Virginia at Richmond, and at the University of Virginia; in Athens and Savannah, Ga.; Graniteville and Charleston, S. C., and at other cities. It is also found in Europe, Syria, and Madeira.

The contrast of colors and the elegant arrangement of the spots and lines render this a beautiful species. The tubercles of the surface are very fine, and so much compressed as to appear in some lights to be carinated. There is often a well-defined row of spots down the back. The eye-peduncles are long and delicate, the mantle sometimes terminates posteriorly in an obtuse point, and the locomotive band of the foot is narrow and well defined. There is a prominent ridge on the head and neck between the eye-peduncles, and a furrow marks the edges of the foot. It is active in its motions, turns rapidly, and often bends the body so as to form two parallel lines. It does not secrete mucus so freely as *Limax agrestis*. The carina is often yellowish. The testaceous rudiment (Vol. I. Pl. I. Fig. V) is oblong-oval, convex above and concave below, thin and membranaceous in young individuals, with the superior surface smooth and covered with a delicate periostracum, and with the lower surface uneven. No spiral arrangement is visible to the eye, and it appears to be only a thin testaceous plate, imbedded in the mantle. In old individuals it attains a greater thickness.

It inhabits cellars and gardens in moist situations in the cities. It is considered noxious to vegetation. It feeds upon the leaves of plants in kitchen gardens, and upon the remains of the cooked vegetables and bread thrown out from houses. Its most common habitat is in cellars, where it makes its presence most disagreeable by attacking articles of food, and especially by insinuating itself into vessels containing meal and flour. It is common, but not so numerous as *Limax agrestis*. The young suspend themselves by a thread of mucus.

This species is of foreign origin, but the period of its introduction is not known. It was noticed by Mr. Say more than fifty years since. It is probable that it inhabits all the cities of the sea-coast, and their vicinage, and most of the cities of the interior.

Jaw (Vol. I. Pl. I. Fig. VI) of a light horn-color, its anterior surface not on one plane, but projecting towards a strong median vertical carina; arcuate, ends square, striated, concave margin smooth, with a well-developed median projection.

The lingual membrane (Pl. I. Fig. G) of one specimen[1] examined has about 60—1—60 teeth, with 16 laterals. The centrals and laterals are of the same type as in *L. maximus*, the outer marginals are also bifid. On other portions of the same membrane the cutting points are longer and sharper. Fig. *c* represents an extreme marginal. Both of the figures of this species, published by me, were drawn from lingual membranes of another species.

The genital system, as well as full anatomy, is figured by Leidy in Vol. I. Pl. I. The testicle (1), composed of a globular mass of aciniform cœca, is not imbedded within one of the lobes of the liver. The penis sac (4) is long, stout, cylindrical, receiving the vas deferens (2) and retractor muscle (5) at its apex. The genital bladder (8) is small, elongated-ovate with pointed apex and short duct.

Limax agrestis, Linn.

Vol. III. Pl. LXIV. Fig. 2.

Color varying from whitish through every shade of cinereous and gray to black, and through various shades of yellowish, or amber-color, to brownish, and sometimes irregularly spotted with small black points or dots; eye-peduncles and tentacles darker than the general surface, sometimes black; mantle sometimes mottled with a lighter color; base of foot sallow white; sheath of eye-peduncles indicated by black lines extending backwards from their base under the edge of the mantle. Body when in motion cylindrical, elongated, terminating acutely, the sides towards its posterior extremity compressed upwards, so as to form a short carina or keel; foot very narrow. Mantle oblong-oval, fleshy, convex, and prominent, rounded at both extremities, equalling in length one third of the length of the body, its surface marked by prominent, irregularly waved, concentrical lines and furrows having their centre on the posterior part, and its edges free throughout the whole circumference. Upper surface of the body marked with longitudinal lines or shallow furrows, darker than the general surface, sometimes black, anastomosing with each other, and forming a sort of network; between the reticulated lines are narrow, irregular oblong plates, or smooth, flattened tubercles, giving the surface the appearance of a mosaic work, with lines of dark cement; reticulations less distinct on the sides, and disappearing towards the base; a prominent tubercular ridge extends from between the eye-peduncles backward to the mantle, with a furrow on each side. Eye-peduncles cylindrical, about one eighth the length of the body, with small, black, ocular points on the superior part of the terminal bulb; tentacles immediately under, very short. Respiratory foramen near the posterior lateral edge of the mantle, large, surrounded with a whitish border. Orifice of rectum immediately adjacent, but a little above and anterior to the respiratory foramen. Foot narrow; locomotive band bounded by two distinct longitudinal furrows.

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[1] L. & Fr.-W. Sh. N. A., I. p. 63, Fig. 105, is no doubt *L. agrestis*. Fig. 6, p. 285, of Ann. Lyc. N. H. N. Y., Vol. IX., would more correctly represent the dentition of this species, if the extreme marginals were bifid.

Generally about 25 mill. in length, but when fully grown nearly 50 mill.

Limax agrestis, LINNÆUS, Syst. Nat. [x.], 1758, I. 652. — MOQUIN-TANDON, REEVE, etc. — BINNEY, Bost. Journ. Nat. Hist., IV. 166 (1842); Terr. Moll., II. 37, Pl. LXIV. Fig. 2 (1851). — LEIDY, Terr. Moll., I. 250, Pl. II. Figs. 7-9 (1851), anat. — DEKAY, N. Y. Moll., 20, Pl. I. Fig. 4 (1843). — TRYON, Am. Journ. Conch., III. 315 (1868). — W. G. BINNEY, L. & Fr.-W. Sh. N. A., I. 64 (1869). — GOULD and BINNEY, Inv. of Mass. ed. 2, 408 (1870). — MORSE, Journ. Portl. Soc., I. 7, Fig. 1, Pl. III. Fig. 2 (1864).
Limax tunicata, GOULD, olim, Invert. 3 (1841).

It is undoubtedly of European origin. Inhabiting Boston, New York, Philadelphia, and other maritime cities of the Atlantic coast; also in Greenland.[1] It is common in the neighborhood of Boston, under stones at roadsides, and about stables and farmyards, and in other moist situations, under wet and decaying pieces of wood. It is also found in cellars and gardens, and causes some mischief by its depredations. A considerable number of individuals often congregate in the same retreat. Their food appears to be the green leaves of succulent plants, and sometimes ripe fruits; they feed during the night, and are rarely found out of their retreats in the daytime. Their growth is rapid, the animal excluded from the egg in the spring arriving at full maturity and producing eggs before the succeeding winter. They defend themselves from injurious contact by instantly secreting, at the part touched, a quantity of milky-white, glutinous mucus. They are active in their motions, and soon escape when disturbed. Suspending themselves, head downwards, they lower themselves from plants and fences by forming a mucus thread which they attach to the point from which they hang. They are occasionally seen in this situation in rainy weather. During the process of excreting the mucus thread the alternate undulating expansions and contractions of the locomotive band of the foot are seen to take place in the same manner as when they are in motion on a plane surface.

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[1] Doubted by Mörch, Am. Journ. Conch., IV. 37.

This species is much more prolific than the others, the number of eggs deposited during the year being sometimes several hundred; its numbers, in favorable localities, are therefore very great. It begins to lay its eggs early in the spring, and continues, with intervals, until checked by the cold of approaching winter. The last deposit of them often remains in the soil until the succeeding spring, when they are hatched with the first generation of the year. The eggs are semi-transparent, and nearly globular. They produce young in about twenty days after they have been deposited.

M. Bouchard-Chantereaux has observed them to deposit eggs in sixty-six days after their own birth, and to attain their full size in eighty-two days.

This species varies very much in color, and the descriptions by different authors, being drawn principally from it, differ greatly from each other; but whatever may be the color, the peculiar character of the furrows and the tubercles remains constant. In a state of contraction the back is arched; the head is entirely withdrawn under the mantle; the glands of the skin are very prominent, making the surface appear rough; the carina is more apparent; and the posterior extremity, being a little turned to one side, appears to be oblique. It is described by some authors as constantly oblique, but the obliquity disappears when the animal is fully extended. When in motion, the head extends considerably beyond the mantle, and there is an interval between its margin and the base of the eye-peduncles equal to the length of the tentacles. The mantle adheres to the body by its posterior central portion, and it is in this part of it that is found imbedded the testaceous rudiment, or shell. This is oval, curved above, very thin and delicate, having a transparent epidermis. At its posterior part there is a slight apical prominence, and the appearance of indistinct concentric lines of growth.

There is no considerable variation in the species except in regard to color, which varies almost infinitely.

Jaw wide, low, slightly arcuate, with broad median projection.

Limax agrestis[1] (Pl. I. Fig. H) has about 50—1—50 teeth on its lingual membrane, with 18 perfect laterals. The centrals have a much more graceful outline to the reflection than in the two last-named species. The median cusp is longer and more slender, with a more slender cutting point; the subobsolete side cusps are more marked, and bear well-developed, triangular, slightly curved cutting points. The lateral teeth are like the centrals, but unsymmetrical by the suppression of the inner lateral lower expansion of the base of attachment. There is, however, an inner cutting point lying against the inner side of the cusp, rather than in a position corresponding to the outer cutting point; it is very difficult of detection, being on a different plane from the outer cutting point, and readily confounded with the inner lower angle of the base of attachment. It is figured by Lehmann and Heynemann. The marginals are long and slender, without bifurcation even on those on the extreme edge of the membrane. Fig. 105 of p. 63 of L. & Fr.-W. Sh. N. A., I., probably was drawn from a specimen of this species, certainly not from one of *flavus*.

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[1] The figure given of the marginals of *L. agrestis* by Lindström (Gotlands nutida Mollusker, Pl. I. Fig. 3) disagrees with my observation by the bifurcation of the marginals.

Goldfuss (l. c. Pl. V. Fig. 4) omits the cutting points from his figure.

The genitalia, as well as complete anatomy, are figured by Leidy (Vol. I. Pl. II. Figs. 7–9). The genital bladder (7) is short, narrowly elongate ovate, with blunt apex and short duct. The penis sac (4) is peculiar; it is short and stout, narrowing towards its apex, where it is extended into a short, trifurcate gland (3); the retractor muscle (5) is attached on the side of the penis sac, below this gland.

Limax campestris, Binney.

Vol. III. Pl. LXIV. Fig. 3.

Color usually of various shades of amber, without spots or markings, sometimes blackish; head and eye-peduncles smoky; body cylindrical, elongated, terminating in a very short carina at its posterior extremity; mantle oval, fleshy, but little prominent, with fine concentrical lines; back covered with prominent elongated tubercles and furrows; foot narrow, whitish; respiratory foramen on the posterior dextral margin of the mantle; body covered with a thin, watery mucus. Length, about 25 mill.

Limax campestris, Binney, Proc. Bost. Soc., 1841, 52; Bost. Journ. Nat. Hist., IV. 169 (1842); Terr. Moll., II. 41, Pl. LXIV. Fig. 3. — Adams, Shells of Vermont, 163 (1842). — DeKay, N. Y. Moll., 23 (1843). — Leidy, T. M. U. S., I. 250, Pl. II. Figs. 5, 6 (1851), anat. — Tryon, Am. Journ. Conch., III. 315 (1868). — W. G. Binney, L. & Fr.-W. Sh., I. 66 (1869). — Gould and Binney, Inv. of Mass., 409 (1870).

Limax campestris, var. *occidentalis*, J. G. Cooper, Proc. Ac. Nat. Sc. Phila. 1872, 146, Pl. III. Fig. C.

Inhabits all the New England, Middle, and Western States, and is probably widely diffused through the Northern and Interior Regions. Found also at Aiken, S. C. It has also been quoted from the Pacific Region as var. *occidentalis*. (See next page.)

The resemblances between some of the species of this genus are so great that it is difficult to provide them with distinctive characters, and it is only by close comparison that their differences can be seen. The present species, although considerably smaller, is nearly allied to *Limax agrestis*. Its differential characters are as follows: It is always much smaller, and at all ages possesses a peculiarly gelatinous or semi-transparent consistency. The tuberosities of the surface are more prominent in proportion to their size, are not flattened or plate-like, and are not separated by darker-colored anastomosing lines, the intervening furrows being of the same color as the general surface. It does not secrete a milky mucus at every part of the surface when touched. Like that species, it is active in its motions, and suspends itself by a thread of mucus. In its genitalia it differs widely in wanting the curious trifurcate gland to the penis sac found in *agrestis*, and in the shape of the genital bladder and length of its duct.

This species appears to be common to all the northern parts of the United States. It is found under decaying wood in the forests and in open pastures, and under stones at roadsides. From its wide distribution it would seem to be indigenous.

Its testaceous rudiment is minute and delicate in proportion to the small size of the animal.

Mr. Gwyn Jeffreys (Ann. Mag. Nat. Hist. 1872, p. 245) suggests the identity of *campestris* with *lævis*, Müll., a European species. Lehmann's figure of the genitalia and dentition of that species show that there is no foundation for any such theory.

Jaw as usual in the genus. Ends pointed, recurved; centre with a transverse, strong line of reinforcement; median projection sharp.

Lingual membrane (Pl. I. Fig. I). One specimen has 40—1—40 teeth, with 18 perfect laterals. Another gives 36—1—36, with 11 perfect laterals. The centrals and laterals are of the same type as described above in *L. agrestis*, excepting that there is no peculiar inner side cutting point to the first laterals. About half of the marginals are bifid. I find great difficulty, however, in detecting any bifurcation on the extreme marginals.

As stated above, Heynemann's figure of the dentition of *L. Weinlandi* could not have been drawn from this species. I have no information in regard to *L. Weinlandi* other than what I find in Malak. Blätt. X. 212, Pl. III. Fig. 1. Judging from the dentition alone, I should hardly consider it distinct from *agrestis*, excepting in its wanting the peculiar inner side cutting point to its first laterals.

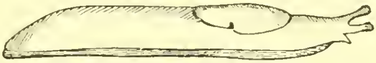
The California form noticed by Dr. Cooper as var. *occidentalis* is known to me by a single specimen received living from him. In external appearance, genitalia, and jaw it cannot be distinguished from the Eastern form. Its lingual membrane (Pl. I. Fig. L) has 35—1—35 teeth, of which 13 are laterals. The inner as well as outer laterals show occasionally the side spur, thus more nearly resembling those of *montanus* than *campestris*. I am inclined to believe future study will prove all three forms identical, notwithstanding these slight differences in detail of dentition.

Limax Hewstoni, J. G. Cooper.

Similar to *L. Sowerbii* (of England), the back being strongly carinate even when fully extended, and higher than the front of the body; mantle granulate-rugose, and with a groove, subelliptic in outline, above the level of the respiratory orifice, which is just behind the middle; color blackish-brown or deep black above, the sides paler, the base of foot whitish. Length, 2½ inches or less, height of body twice the width of foot.

Internal plate oblong-oval, $\frac{1}{6}$ inch long. Gardens in San Francisco.

Fig. 58.



Limax Hewstoni.

In the remarkable groove on the mantle it differs from others described. This does not coincide with the outline of the attached portion of the mantle, or with the internal plate. It is sometimes scarcely visible. (Cooper.)

Limax Hewstoni, J. G. COOPER, Proc. Ac. Nat. Sc. Phila. 1872, 147, Pl. III. Fig. B, 1 – 5.

Jaw as usual in the genus.

Lingual membrane (Pl. I. Fig. J): the centrals and laterals are of the same type as in the last species, with this important difference, that there is a well-developed cutting point of the usual form (not the peculiar form, as in *L. agrestis*) to the inner subobsolete cusp of the laterals, and the inner lower lateral expansion of the base of attachment of the laterals is not suppressed as usual to make the laterals asymmetrical. From this it follows that the central teeth are with difficulty distinguished from the laterals, until the outer ones are reached, when the inner cutting point and inner lower lateral expansion of the base of attachment are suppressed, as in the other species of *Limax*. The marginal teeth are not bifid. Teeth 30—1—30, with 14 perfect laterals. Fig. *c* represents the very last marginal. As in the membranes of almost all species of land shells, there is considerable difference in the marginals on different portions of the same membrane. Those figured are the least slender. The specimens examined are from the State collection of California, presented by Dr. J. G. Cooper.

This species, by the presence of the inner cutting point of the laterals and non-bifurcation of the marginals, resembles *Limax* (*Amalia*) *gagates*, as figured by Semper (Phil. Archip., Pl. XI.), and *Amalia marginata*, as figured by Heynemann (l. c. Pl. III. Fig. 7). Goldfuss also (l. c. 1856, Pl. IV. Fig. 3) figures the dentition of *L. marginatus* as the same.

Dr. Cooper suggests its having been introduced from China or elsewhere, as he found it only in the city of San Francisco.

So far as outward appearance goes, the species somewhat resembles *Amalia marginata*, Drap., as figured by Lehmann (Lebenden Schnecken. Pl. V. Fig. B). It is, however, by no means certain that it was introduced into San Francisco, as Mr. H. Hemphill has sent me specimens of an *Amalia* from Los Angeles. His species had about 48 teeth in each row, 16 being laterals, the balance marginals; a difference of arrangement which may fairly be considered to show a specific difference between his specimens and the San Francisco form, though his discovery leads us to consider *Amalia* as native to California.

The oviduct is long and greatly convoluted. The prostate is well developed. The vagina is very short; the very short duct of the genital bladder enters at about its middle. The last-named organ is large, globular. The penis sac is small, short, cylindrical, expanded, and bulbous at its apex, where the vas deferens enters. I could detect no accessory organs in the single specimen imperfectly examined (Pl. XI. Fig. F).

The genitalia are somewhat of the same type as those of *L. flavus*, but the dentition of the latter is quite distinct (see above). There is a still stronger resemblance to the genitalia of *Amalia gagates* as figured by Semper (Phil. Archip., Pl. XI. Fig. 9), so far as the penis and genital bladder are concerned.

Limax montanus, INGERSOLL.

Color bluish-gray. Form stout, with blunt posterior extremity. Length exceeding one inch. Hot Sulphur Springs, Colorado.

Limax montanus, INGERSOLL, Bull. U. S. Geol. and Geogr. Survey of the Territories, No. 2. second series, 132 (1875); ed. 2 (1876), p. 394, Figs.
Limax castaneus, INGERSOLL, l. c., ed. 2, p. 396.

The above is Ingersoll's description. Specimens received from him furnish the anatomical details here given.

It is a species of the Central Province.

Jaw as usual in the genus. Lingual membrane long and narrow. Teeth 50—1—50, with 16 perfect laterals. Centrals with base of attachment slightly longer than wide; inferior lateral angles not much produced, lower margin incurved; reflection slightly shorter than one half the base of attachment; tricuspid, the outer cusps short, stout, bearing short, stout cutting points; the median cusp stout, reaching almost to the lower edge of the base of attachment, beyond which projects the cutting point; laterals like the centrals, but asymmetrical, as usual, by the suppression of the inner cusp with its cutting point and inner lower lateral expansion of the base of attachment. There are 16 perfect laterals, beyond which are several teeth forming the usual gradual transition to the marginals. These latter are aculeate, the cutting points bearing at about the centre of their lower edge a blunt spur, which is a modified form of the bifurcation of the marginal teeth often found in *Limax*. The marginal teeth have the usual characteristic arrangement in oblique rows, and the separate teeth, as they pass outward, have at first the rapid increase for a short distance, and thence gradual decrease in size, usual in *Zonites*.

In the genital system (Pl. XII. Fig. B) there are no accessory organs. The penis sac is as long as the vagina, with a constriction near its commencement, and tapers above to a point, below which it receives the vas deferens. The genital bladder is oval, with a very short duct entering the vagina above the penis sac. The arrangement is very nearly that of *L. campestris*.

This species is referred to by me as *L. Ingersolli* in Proc. Ac. Nat. Sc. Phila. 1875, and in Ann. Lyc. of N. H. of N. Y., X. 169.

Limax castaneus is a variety of this species.

Jaw as usual; lingual dentition as in the other form, but differing in having only 34—1—34 teeth, with 12 perfect laterals (Pl. I. Fig. K). This important difference is such as to warrant the belief that the form may prove a distinct species. Genitalia not examined. Blue River Valley, Colorado.

It is described thus by Ingersoll: Small and slender; length less than one inch; color, a lively brown, with a darker spot over the shield; head, tentacles, and eye-stalks black. Bottom of foot white.

Spurious Species of Limax, etc.

Limax marmoratus, DeKay. See *Tebennophorus Caroliniensis.*

Limax Columbianus, Gould and Tryon, I have referred to *Ariolimax.*

Limax fuliginosus, Gould, and

Limax olivaceus, Gould, are erroneously referred to America by Grateloup (Distr. Geog. Lim. p. 30).

Limax Weinlandi (see p. 150).

Limax lineatus, DeKay (see Terr. Moll., II. 33), is mentioned by name only, without description.

To Vol. I. p. 48 *et seqq.* and Vol. IV. p. 32, I refer for information regarding the following species of Rafinesque. Some of them are mentioned by Férussac, Gray, Grateloup, etc., but no additional information is given by them: —

Limax gracilis (*Deroceras*). See also DeKay, N. Y. Moll., 22; Gray and Pfeiffer, Brit. Mus. Cat.

Eumelus lividus.

Eumelus nebulosus.

Rafinesque also mentions — by name only, though not from America, no locality being given — *Zilotea*, *Urcinella*, and *Testacina* (Analyse de la Nature; see Binney and Tryon's edition of Rafinesque, 17).

C. HOLOGNATHA HELICEA.

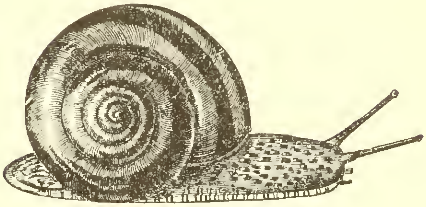
Jaw in one piece; marginal teeth quadrate.

In grouping the genera of this section, I have placed (1) those whose jaw is ribless; (2) those whose jaw has decided ribs; (3) those whose jaw has delicate, distant ribs, giving the appearance of dividing the jaw into plates, the ribs usually running obliquely towards the centre of the jaw. These divisions are, however, adopted only provisionally. Even now they seem to be in many cases unreliable. I am led to believe that these modifications will eventually be proved of not even generic value. See my remarks on the jaw of *Dentellaria.*

(1) Jaw without decided ribs on its anterior surface.

PATULA, Hald.

Fig. 59.



Animal of *Patula solitaria.*

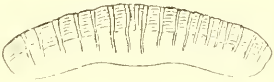
Animal heliciform; body elongated, semi-cylindrical, tapering to a point posteriorly, convex above, plane beneath; mantle simple, central, not extending beyond, and accurately fitting to the peristome of the shell, into which the whole animal may retire; head obtuse; eyes at the end of long, cylindrical, retractile peduncles; tentacles short, retractile; generative orifice on the side of the head, behind the right eye-peduncle; respiratory orifice in the collar, at the angle of the aperture of the shell, anal orifice immediately adjoining; no caudal mucus pore, no locomotive disk.

Shell widely umbilicated, depressed, discoidal, turbinate, rugose, or costulately striate; whorls 4 – 6, equal or gradually increasing; aperture lunately rounded; peristome simple, straight, acute.

As there appears considerable confusion in regard to the limits of the genus, I think it best to make no reference to any species foreign to North America. Here it ranges over both the Central and Eastern Provinces.

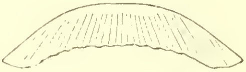
In none of the American species of this genus have I found a jaw with distinct well-formed ribs as in *Helix*. In several species, however, such as *strigosa* and *Cooperi*, there are distinct traces of subobsolete ribs near the cutting margin, and still more so in *incrustata*. In *asteriscus* there are coarse wrinkles, resembling subobsolete ribs. In *perspectiva*, *striatella*, and *Idahoensis* there are such wrinkles, and also coarse vertical striæ. I have not found the striæ as oblique as shown in Fig. 61. In *solitaria*, *alternata*, and *Hemphilli* there are no traces of either ribs, wrinkles, or striæ. In all these species there is a tendency to a median projection to the cutting edge. This is greatly developed in *solitaria*, *alternata*, *Cumberlandiana* (with perpendicular striæ), and especially in *Hemphilli*. The last two species have also a much more arcuate jaw than the others. I have not seen the jaw of *Horni* or *pauper*.

Fig. 60.



Jaw of *Patula asteriscus* (Morse).

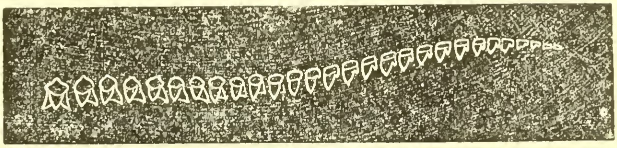
Fig. 61.



Patula striatella (Morse).

Fig. 62 shows the general arrangement of the teeth on the membrane. The characters of the individual teeth are better shown on Pl. IV.

Fig 62.



P. Cumberlandiana.

There is a considerable difference in the lingual dentition of the species I have grouped in this genus as to the development of the side cusps to the central and lateral teeth, and the presence of distinct cutting points upon these cusps. Such cusps and points are present in *solitaria*, *alternata*, *perspectiva*, *striatella*, *Hemphilli*, *Idahoensis*, *asteriscus*. I do not detect these cusps in *P. strigosa*, *Cooperi*, probably the same species, or *Cumberlandiana*, excepting on the outer laterals.

The central and lateral teeth of all the species examined by me are, in other respects, as usual in the *Helicea*. It will be noticed that the base of attachment is subquadrate, the reflected portion large (except in *asteriscus*), the cusps short, the cutting points short.

All the outlines of the teeth are less graceful than in *Zonites*. The lateral teeth are made asymmetrical by the suppression of the inner lower angle of the base of attachment, and the less development, if not suppression, of the inner cusp, which loses the cutting point also. The marginal teeth are quite different from those of *Zonites*, *Limax*, *Vitrina*, *Macrocyclis*, and *Glandina* in not being aculeate. They are more crowded than in those genera. They have a quadrate base of attachment, not sole-like, shortened on its inner lower side, but produced at its outer lower margin. The reflected portion is as wide as the base of attachment, is more produced than in the central and lateral teeth, retains its width throughout, and bears two oblique, blunt cutting points, the inner one always much the larger and longer, and the outer one of which, in most of the species, has a tendency to bifurcation. There is considerable variation in these cutting points even in the same lingual membrane, but as a general thing it may be said that the marginal teeth are but a modification of the form of the laterals. They decrease in size greatly at the outer edge of the lingual membrane.

It must be borne in mind that the cutting points vary in development on different portions of any one lingual membrane. I have in each case chosen for drawing such individual teeth as appear best to illustrate the general character of the dentition.

It will be seen that *Patula* differs from all the preceding genera by the presence of quadrate, not aculeate, marginal teeth, a character shared by all the succeeding genera. There does not appear any very essential character in the dentition by which to distinguish it from many of the other American genera of disintegrated *Helix*, as will be seen below. It will be noticed that one species, *asteriscus*, has marginal teeth like those of *Pupa* and *Vertigo*.

Patula solitaria, Say.

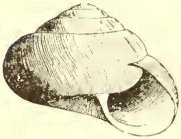
Vol. III. Pl. XXIV.

Shell broadly umbilicated, globosely depressed, coarse, solid, diaphanous, obliquely and crowdedly wrinkled, from white to dark reddish horn-color with from two to three brownish revolving bands; whorls 6, convex; suture deep; aperture roundedly lunate, pearly white and banded within; peristome simple, acute, its ends joined by a thin transparent callus, that of the columella dilated, subreflected. Greater diameter 25, lesser 22 mill.; height, 15 mill.

Helix solitaria, Say, Journ. Phila. Acad., II. 157 (1821); Binney's ed. 19. — DeKay, N. Y. Moll. 43, Pl. III. Fig. 41 (1843). — Binney, Bost. Journ. Nat. Hist., III. 426, Pl. XXII. (1840); Terr. Moll., II. 208, Pl. XXIV. — Chemnitz, 2d ed., I. 180, Pl. XXIV. Figs. 5, 6. — Pfeiffer, Symbolæ, II. 39; Mon. Hel. Viv., I. 102. — Reeve, Con. Icon., 662 (1852). — W. G. Binney, Terr. Moll., IV. 96. — Leidy, T. M. U. S., I. 254, Pl. VIII. Figs. 7-10 (1851), anat. — W. G. Binney, L. & Fr.-W. Sh., I. 71, Fig. 119 (1869).
Anguispira solitaria, Tryon, Am. Journ. Conch., II. 260 (1866).

Microscopic revolving lines have been detected on some specimens. There is a form of a dark reddish-brown color, with one white band at the periphery, and the same color at the base around the umbilicus. Albino forms are also found (see Fig. 63).

Fig. 63.



Var. *Albino*.

The Museum of Comparative Zoölogy has a reversed specimen.

A Post-pleiocene species now very common in the Interior Region, especially in the parts north of the Ohio River. I have never received it south of Missouri. It has ranged widely westward, having been found in the Cœur d'Alene Mountains in Idaho, associating with *strigosa*. Thus it is the only species of the Interior Region which has crossed the barrier of the Rocky Mountains. It has even passed the Cascade Mountains into the Pacific Region, having been found living at the "Dalles," and on "Government Island" in the Columbia River, within twelve miles of Fort Vancouver, by Mr. O. B. Johnson, who has sent specimens to the Smithsonian Institution, which I have myself seen.

Jaw long, low, slightly arcuate, ends but little attenuated; anterior surface striate, but without ribs. A median projection to the cutting margin.

The lingual membrane (Pl. IV. Fig. K) has 25—1—25 teeth, with 14 perfect laterals. The transition to marginals is very gradual.

The anatomy of this species is figured by Leidy (l. c.). The genitalia present several peculiar features. The penis sac (5) is short, stout, receiving near its apex the retractor muscle (6), above which it rapidly decreases in size, and at its apex receives the vas deferens (2); the last-named organ is very peculiar in being greatly convoluted before entering the penis sac; the genital bladder (9) is small, globular, on a long duct, which becomes swollen at its lower end; the epididymis (2) is convoluted in its entire course.

Patula strigosa, GOULD.

Vol. III. Pl. XXVI. a.

Shell broadly umbilicated, orbicular, slightly and about equally convex above and beneath, surface irregular, and roughened above by indentations and coarse lines of growth, and by occasional fine revolving lines; smoother and shining beneath; color ashy-gray, somewhat mottled with dusky or altogether rusty brown above, with, usually, a single, faint, revolving band on the middle of each whorl, and often with numerous bands, unequal in size and distance, beneath; whorls 5, moderately convex, the last one carinated at its commencement, and deflexed; aperture very oblique, circular; peristome simple, acute, almost continuous, terminations approaching, joined by thick callus, that of the columella subreflected. Greater diameter 21, lesser 18 mill.; height, 10 mill.

Helix strigosa, GOULD, Proc. Bost. Soc. Nat. Hist., II. 166 (1846); Expl. Exped. Moll. 36, Fig. 41 (1852); Terr. Moll., II. 210, Pl. XXVI. a. — PFEIFFER, Mon. Hel. Viv., I. 121; IV. 91; Mal. Bl. 1857, 321. — W. G. BINNEY, Terr. Moll., IV. 23; L. & Fr.-W. Sh., I. 72 (1869).

Anguispira strigosa, TRYON, Am. Journ. Conch., II. 261 (1866).

Helix Cooperi, W. G. BINNEY, Proc. Acad. Nat. Sci. Phila. 1858, 118; Terr. Moll., IV. 97, Pl. LXXVII. Fig. 11; L. & Fr.-W. Sh., I. 78, Figs. 132-137 (1869). — PFEIFFER, Mal. Blätt. 1859, 6.

Anguispira Cooperi, TRYON, Am. Journ. Conch., II. 260 (1866).

Helix Haydeni, GABB, Am. Journ. Conch., V. 24, Pl. VIII. Fig. 1 (1869).

This species seems to inhabit all of the Central Province from New Mexico on the Rio Piedro to the British Possessions. It is also found in the mountainous country east of the Rocky Mountains in the Eastern Province, at least as far east as long. 108°. It has also penetrated the Pacific Province, having been found in Eastern Oregon.

The species is viviparous. Seventeen embryonic shells were found in one individual, of which the largest had three whorls.

A large specimen in my cabinet has a larger diameter of 26 mill.

It will be seen from the above synonymy that I have become convinced of the identity of *strigosa* and *Cooperi*. Pl. XXVI. a, of Vol. III. represents the former, while the following figures give various forms of the latter. I repeat the description of the typical *Cooperi*: —

Shell umbilicated; elevated, globose; solid, coarse and rough with oblique incremental striæ intersected with delicate spiral lines; color white, variously marked with a single narrow band, or broader longitudinal and spiral patches of reddish-brown, sometimes uniformly red; suture impressed; spire elevated; whorls 5, convex, the last rounded, very decidedly deflected at the aperture; umbilicus moderate, pervious, one fifth the greater diameter of the shell; aperture very oblique, circular; peristome simple, thickened, with its extremities very nearly approached, and joined by a heavy white callus, that of the columella reflected. Greater diameter 20, lesser 16 mill; height, 13 mill.

Fig 64.

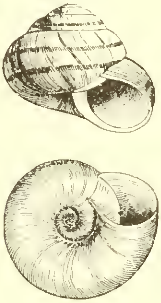
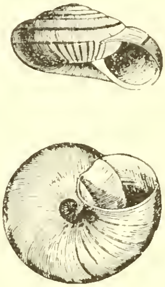


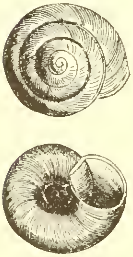
Fig. 65.



Helix Cooperi

The species varies greatly in shape, as seen in the figures given of various forms. It is sometimes strongly carinated, and the peristome is sometimes continuous by the heavy, raised callus connecting its extremities. (Fig. 66.)

Fig. 66.



Helix Cooperi.

Mr. Ingersoll remarks: "This well-known *Helix*, the largest of any collected, was not uncommon in Middle Park and North Park, Colorado, where great numbers of dead shells would be found in isolated spots; only a few live ones being found in wet places in the vicinity. In the Blue River Valley we crossed a belt a hundred yards or so wide, and apparently miles in length, where the surface was thickly strewn with bleached shells, as though an army of these mollusks had been overtaken on the march by universal destruction."

Jaw (*strigosa*) long, low, slightly arcuate; anterior surface smooth excepting near the lower margin, where there are numerous, crowded, subobsolete ribs, or coarse striæ, crenellating the cutting edge. There is a very strong muscular attachment to the upper margin. The jaw of extreme forms of *Cooperi* is the same.

The lingual dentitition of each form is alike, but I figure that of each.

In *P. strigosa* (Pl. IV. Fig. H) there are 50—1—50 teeth, with 15 perfect laterals; *c* is an extreme marginal.

P. Cooperi has (Pl. IV. Fig. G) 29—1—29 teeth, with 11 perfect laterals.

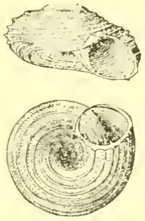
Pl. XI. Fig. A represents the genitalia of a Salmon River specimen of the typical *strigosa*. The testicle, as usual, was in the summit of the upper lobe of the liver. The epididymis is long, convoluted in its half nearer the testicle. The accessory gland is composed of several long, black cœca. The oviduct is sac-like, not convoluted, containing eight embryonic shells. The genital bladder is small, with a long, narrow duct entering the upper part of the vagina, near which it is swollen. The vagina is short and swollen. The penis sac is long, stout, blunt at apex, where the retractor muscle is inserted. The vas deferens becomes greatly swollen before it enters the sac of the penis, which it does above the insertion of the retractor muscle.

As the shells of some forms of this species are difficult to distinguish from some forms of *Patula solitaria*, it is interesting to state that the genitalia of a specimen of the latter from the same locality offer very distinct specific characteristics, agreeing with Dr. Leidy's figure in Vol. I.

Since the above was written, I have received from Mr. Henry Hemphill specimens of *H. Haydeni* with the animal, and so variable that I am convinced of its being a variety of *strigosa*. The revolving lines are not always present, and vary greatly in development. The young shells have erect coarse hairs on the revolving lines.

The discovery is an interesting one, as the species was formerly considered extinct. One of the original lot of specimens is here figured. Mr. Hemphill found several curious varieties.

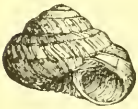
Fig. 67.



P. Haydeni.

The jaw of *Haydeni* (Pl. XVI. Fig. G), as well as its genitalia and viviparous habit, is the same as in *strigosa*. Its lingual dentition I figure on Pl. XVI. Fig. B. There are 33—1—33 teeth. The eleventh tooth has the side cusp and cutting point.

Fig. 68.



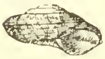
H. Cooperi var.

Another curious form of this protean species was also found by Mr. Hemphill in the same locality, a spur of the Wahsatch Range forming the western boundary of the valley in which Salt Lake City lies. This form is here figured. Its dentition is given on Pl. XVI. Fig. A. There are 27—1—27 teeth, the tenth having the side cusp and cutting point. The jaw and genitalia are as in *strigosa*. Small specimens of this curious form resemble *P. Idahoensis*. The latter, however, as well as *P. Hemphilli*, has side cusps and cutting points to central and all the lateral teeth of the lingual membrane.

Patula Hemphilli, Newcomb.

Shell widely umbilicated, sublenticular, rough, with incremental wrinkles, and minute revolving striæ, bearing separated, short, stout bristles; dirty white, with a revolving reddish band; spire slightly elevated, apex obtuse; whorls 4, the last strongly carinated and deeply excavated towards the suture, scarcely descending; aperture oblique, banded within; peristome thin, acute, angular, its terminations approached; umbilicus very wide, showing all the volutions. Greater diameter 12, lesser 10 mill.; height, 4 mill.

Fig. 69.



P Hemphilli.

Helix Hemphilli, Newcomb, Am. Journ. Conch., V. 165, Pl. XVII. Fig. 4 (1869 – 70).

A species of the Central Province, having been found in the White Pine mining-district, Nevada; Manitou, Williams Cañon, Colorado.

Jaw thick, very much arched, of almost uniform breadth throughout; striate transversely and vertically; ends not attenuated, squarely truncated; cutting edge with a blunt, prominent, median projection. A stout upper muscular attachment.

P. Hemphilli (Pl. IV. Fig. J) has 20—1—20 teeth on its lingual membrane, with 7 perfect laterals. The first laterals are distinctly bicuspid.

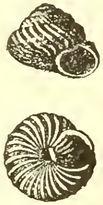
The species is viviparous. Genitalia not otherwise observed.

Patula Idahoensis, Newcomb.

Shell umbilicated, globosely elevated, thick, white, rough, with stout, distant, oblique, curving, blunt ribs, of which 28 are upon the last whorl; suture impressed; spire highly elevated; apex waxen, smoother, obtuse; whorls 5, convex, the last equally globose above and below, hardly falling before; umbilicus moderate, one sixth the lesser diameter of the shell; aperture oblique, almost circular; peristome simple, made almost continuous by a heavy parietal callus connecting its approximating ends, that of the columella slightly expanded and reflected over a portion of the umbilicus. Greater diameter 13, lesser 11 mill.; height, 7 mill.

Helix Idahoensis, Newcomb, Am. Journ. Conch., II. 1, Pl. I. Figs. 1–3 (1866).—W.G. Binn., L. & Fr.-W. Sh., I. 79, Fig. 138 (1869).
Anguispira Idahoensis, Tryon, Am. Journ. Conch., II. 260 (1866).

Fig. 70.



P. Idahoensis.

Idaho Territory, between Idaho City and Cœur d'Alene mining-district, in the Central Province.

The shell figured was received from Dr. Newcomb. The species in texture and form resembles somewhat a small elevated *Cooperi*.

The jaw very much resembles in form and in its crenellated cutting edge that of *Patula striatella*. Its anterior surface has coarse perpendicular striæ or obsolete wrinkles, not well-formed ribs. There is a stout membranous attachment to the upper margin.

P. Idahoensis (Pl. IV. Fig. I) has 33—1—33 teeth on its lingual membrane, with 14 perfect laterals. The transition from the laterals to the marginals, however, is very gradual. This species and *Hemphilli* have side cusps and cutting points on the central and first laterals, while *strigosa* does not.

Genitalia not examined.

Patula alternata, Say.

Vol. III. Pl. XXV.

Shell broadly umbilicated, orbicularly depressed, thin, smoky horn-color varied with red, interrupted, obliquely arranged patches and spots, roughened by crowded, elevated rib-like striæ, smoother below; whorls $5\frac{1}{2}$, flattened, the last sometimes obtusely carinated at its periphery; umbilicus large, pervious; aperture very oblique, lunately rounded, banded within; peristome simple, acute, its terminations joined by a very thin, transparent callus, that of the columella subreflected. Greater diameter 21, lesser 19 mill.; height, 10 mill.

Helix alternata, Say, Nich. Encycl., Pl. 1. Fig. 2 (1817 - 19); Journ. Philad. Acad., II. 161 (1821); Binney's ed. 6, 21, Pl. LXIX. Fig. 2. — Eaton, Zoöl. Text-Book, 193 (1826). — Binney, Bost. Journ. Nat. Hist., III. 428, Pl. XXV. (1840); Terr. Moll., II. 212, Pl. XXV. — Gould, Invert., 177, Fig. 114 (1841). — Leidy, T. M. U. S., I. 253, Pl. VII. Figs. 2 - 5 (1851), anat. — DeKay, N. Y. Moll., 29, Pl. II. Fig. 9 (1843). — Adams, Vermont Mollusca, 162, Fig. (1842). — Férussac, Tab. Syst., 44; Hist., Pl. LXXIX. Figs. 8 - 10. — Potiez and Michaud, Galérie, 104. — Chemnitz, 2d ed., I. 181, Tab. XXIV. Figs. 17, 18. — Pfeiffer, Mon. Hel. Viv., I. 102. — Deshayes in Fér. Hist., I. 89. — Reeve, Con. Icon., 670 (1852). — Billings, Canad. Nat., II. 99, Figs. 4, 5 (1857). — W. G. Binney, Terr. Moll., IV. 98. — Bland, Ann. N. Y. Lyc., VII. — Morse, Amer. Nat., I. 187, Figs. 17, 18 (1867). — W. G. Binney, L. & Fr.-W. Sh., I. 73 (1869). — Gould and Binney, Invert. of Mass., ed. 2, 412 (1870).

Anguispira alternata, Morse, Journ. Portl. Soc., I. 11, Fig. 15; Pl. IV. Fig. 16 (1864). — Tryon, Am. Journ. Conch., II. 261 (1866).

Helix scabra, Lamarck, Anim. sans Vert., VI. part 2, 88. — Deshayes, Encycl. Méth., II. 219 (1830); in Lamarck, VIII. 66; ed. 3, III. 292. — Chenu, Ill., Pl. VI. Fig. 11.

Helix infecta, Parreyss MS., Pfeiffer, Mal. Bl. 1857, 86; Mon. Hel. Viv., IV. 91, non Reeve.

Helix strongylodes, Pfeiffer, Proc. Zoöl. Soc. 1854, 53; Mon. Hel. Viv., IV. 91. — Reeve, Con. Icon., No. 1296 (1854). — *Vide* W. G. Binney, Terr. Moll., IV. Pl. LXXVII. Fig. 8.

Helix mordax, Shuttleworth, Bern. Mitt. 1853, 195. — Gould in Terr. Moll., III. 19. — W. G. Binney, Terr. Moll., IV. 99. — Pfeiffer, Mon. Hel. Viv., III. 635. — Bland, Ann. N. Y. Lyc., VII. (and var. *Fergusoni*).

Helix dubia, Sheppard, Tr. Lit. Hist. Soc. Quebec, I. 194. — McCulloch (where ?), teste Binney, Terr. Moll., I. 192.

It is commonly found in the Post-pleiocene of the Mississippi Valley, retaining some of the color of the red flame-like patches. It now extends over the whole of the Eastern Province as far north as Labrador.

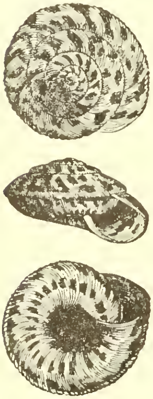
Animal: head and eye-peduncles light slate-color, back brown, remainder of upper surface brownish-orange, eyes black, base of foot grayish-white, collar saffron. Eye-peduncles one third of an inch long, blackish at the extremities.

Foot not much exceeding in length the diameter of the shell, and terminating in a broad, obtuse, and flat extremity. A light marginal line runs along the edge of the foot from the head to the posterior part, those of the two sides meeting in an acute angle.

Variety: head and neck blackish-brown, eye-peduncles blackish, foot brownish, base dirty white. In a single instance the whole animal was entirely black.

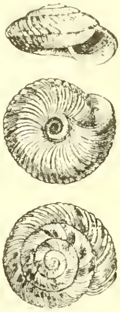
The animal of the ribbed form of *alternata* found at University Place, Franklin County, Tennessee, by Bishop Elliott, resembles in length, etc., *Cumberlandiana:* it is dark slate-color on top of head and eye-peduncles; dirty white on bottom of foot; remainder dark orange.

Fig. 71.



P. alternata, carinated.

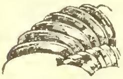
Fig. 72.



P. alternata, var. *mordax?*

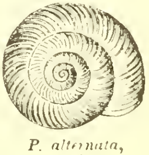
The variation of color ranges from pale straw to dark reddish-brown, in each extreme being sometimes uniform. In outline the variation ranges from depressed to very globose. In sculpturing it varies greatly. A comparatively smooth variety, with a shining, somewhat translucent epidermis, has been noticed in New York, by Mr. Bland, under the name of var. *Fergusoni.* A form with stronger striæ and well-developed carina is figured in Fig. 71. The coarsely striated form, which I presume to be *H. mordax,* is figured also (Fig. 72). This is considered by Mr. Bland to be a variety of *Cumberlandiana.* I have received it from Eastern Tennessee and Virginia. I have also given a figure (Fig. 73) of the magnified surface of a strongly ribbed form from North Carolina, and a view (Fig. 74) of a strongly ribbed form from the Post-pleiocene.

Fig. 73



Surface of *P. alternata.*

Fig. 74.



P. alternata, fossil.

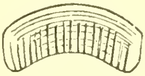
In New England this is perhaps the most common species of the genus. It abounds in the forests, and is not uncommon in the open country in moist situations, where it can find shelter under logs and stumps. It seems to be more gregarious than other species; at any rate, numbers are more frequently found in the same retreat. It does not bear a change from a moist to a dry situation so well as many other species. In captivity it remains buried a great part of the time under the moist earth, with the body half protruded. If removed to the surface, it withdraws within the shell, protects its orifice by three or four coverings, and soon dies unless supplied with moisture.

The foot of the animal is smaller and the eye-peduncles shorter than in either of the other species possessing so large a shell; it is also flatter and thinner. The mantle is deeply tinged with the coloring matter which ornaments the shell, and which is sometimes secreted in such profusion as to give a saffron tinge to the trace which it leaves on objects over which it crawls. It is distributed over the animal, and arranged in minute points, which are most thickly clustered on the margin and on the glandular tubercles of the surface.

There is a reversed specimen in the Museum of Comparative Zoölogy at Cambridge.

The jaw of *alternata*, figured by Morse, is arcuate, equally broad in its whole length, with square ends; anterior surface strongly striate both transversely and vertically; concave margin not strongly crenulated, but having no median projection. A specimen examined by me was much more arched, with attenuated ends, strong median projection, and smooth anterior surface.

Fig. 75.



Jaw of *P. alternata*.

Lingual membrane (Pl. IV. Fig. E): one membrane has 121 rows of 34—1—34 teeth, 10 of which are perfect laterals. The variety *mordax*, Fig. F, agrees with it in dentition, except the number of teeth. I counted 20—1—20, with 8 perfect laterals. The change from laterals to marginals is very gradual.

The anatomy is given by Leidy, l. c. The genital bladder (15) is small, elongate oval, on a long, delicate duct; the penis sac (11) is short, stout, cylindrical, receiving the retractor muscle (12) and the vas deferens at its apex. I have found a similar genital system in the heavily ribbed form and in the var. *mordax*.

Patula Cumberlandiana, Lea.

Vol. III. Pl. XXVI.

Shell broadly umbilicated, lenticular, acutely carinated, rather thin, sculptured with coarse, acute rib-striæ, of a pale yellowish or sometimes ash color, irregularly checked with radiating, waved brown blotches; spire depressed, of about 5 whorls, very slightly convex, but excavated towards the margin, which is acute, and with a marginal, impressed line on both sides of the edge; beneath, somewhat less convex, but the striæ less prominent, and its centre excavated by a deep, broad umbilicus, one third the diameter of the base, and exhibiting all the whorls to the apex; aperture rather wider than high, rendered somewhat rhomboidal by the acute carina; peristome simple, acute, its columellar extremity somewhat dilated and reflected. Greater diameter 15, lesser 13 mill.; height, 5 mill.

Carocolla Cumberlandiana, Lea, Trans. Am. Phil. Soc., VIII. 229, Pl. VI. Fig. 61; Obs., III. 67; Proc., I. 289. — Troschel, Arch. für Nat. 1843, II. 124. — DeKay, N. Y. Moll., 47 (1843).

Helix Cumberlandiana, Pfeiffer, Mon. Hel. Viv., I. 125; III. 114. — Binney, Terr. Moll., II. 216, Pl. XXVI. — Reeve, Con. Icon. 701 (1852). — W. G. Binney, Terr. Moll., IV. 99; L. & Fr.-W. Sh., I. 76 (1869).

Anguispira Cumberlandiana, Tryon, Am. Journ. Conch., II. 262 (1866).

University Place, Franklin County, Tennessee; Jasper, Marion County, Tennessee: a species of the Cumberland Subregion.

Animal dirty white, darker towards the tail, the top of the head and eye-peduncles, which last are dark slate-colored; foot about the length of the lesser diameter of the shell, with a darker submarginal line as in *alternata*, and terminating in a flattened, broad, spade-like extremity like the *Zonites*. When in motion none of the animal protrudes beyond the shell behind (looking from above), before, there is but little visible, about as long as the diameter of the last whorl; the breadth of the animal before the shell is about one half the same diameter.

Found at University Place, Franklin County, Tennessee, now Sewanee, on the Cumberland Mountain table-land by Bishop Elliott (1860). It is limited at that place to a very small space on one of the "benches" of the mountains. In habit they resemble *Cylindrella* and *Cyclostoma*, living in the crevices of precipitous rocks, over the faces of which they may be found walking after rains. *Helicina orbiculata* and a few ribbed *alternata* found with them. Mr. Lea's locality is Jasper, Marion County.

Jaw arched, high; ends blunt; anterior surface with coarse, perpendicular striæ; cutting margin with decided median projection.

Lingual membrane (Pl. IV. Fig. D) long and narrow. Teeth of same type as in *P. solitaria*, *alternata*, etc. The centrals and laterals have, however, a much shorter median cusp. Side cusps subobsolete, and side cutting points wanting on the centrals and first two laterals, the third lateral beginning to show them; the outer laterals, as the seventh lateral, etc., have them well developed. The transition to marginals is very gradual, and is not formed by the bifurcation of the inner cutting point, which remains simple to the extreme outer edge. The smaller, outer cutting point is sometimes bifid in the outer marginals. These last are usually but a simple modification of the laterals, as shown (see plate) in the 20th and 30th teeth. There are 30—1—30 teeth, with hardly 13 laterals, and certainly not so many absolutely perfect ones.

In *P. alternata* there are decided prominent side cusps and cutting points to centrals and first laterals. The shape of the centrals and first laterals also in *alternata* is quite different from those of this species.

The genitalia agree with those of *P. alternata* figured by Dr. Leidy, in Vol. I. Pl. VII. Fig. 2, excepting, perhaps, that in *Cumberlandiana* the genital bladder is smaller, and its duct longer and narrower.

Patula perspectiva, Say.

Vol. III. Pl. XXX. Fig. 1.

Shell broadly and perspectively umbilicated, orbicular, scarcely convex above, excavated below, thin, reddish horn-color, regularly ribbed; whorls 6½, gradually increasing; aperture small, lunately subcircular, within furnished with a single subprominent tooth on the base of the shell; peristome simple, acute, its extremities separated widely. Greater diameter 8, lesser 7½ mill.; height, 3 mill.

Helix perspectiva, SAY, Journ. Phila. Acad., I. 18 (1817); Nich. Encycl., IV. ed. 3 (1819); BINNEY'S ed. 9. — BINNEY, Bost. Journ. Nat. Hist., III. 430, Pl. XXI. Fig. 4 (1840); Terr. Moll., II. 256, Pl. XXX. Fig. 1. — DEKAY, N. Y. Moll., 42, Pl. III. Fig. 38 (1843). — FÉRUSSAC, Tab. Syst., 44; Hist. Nat. des Moll., Pl. LXXIX. Fig. 7. — DESHAYES in LAM., VIII. 130; 3d ed., III. 315; in FÉR., I. 81. — CHEMNITZ, 2d ed., II. 114, Tab. LXXXV. Figs. 30-32; PFEIFFER, Mon. Hel. Viv., I. 103; III. 99 (excl. *H. filiola*). — REEVE, Con. Icon., 695. — W. G. BINNEY, Terr. Moll., IV. 122. — LEIDY, T. M. U. S., I. 453, Pl. VII. Figs. 4-7 (1851), anat. — W. G. BINNEY, L. & Fr.-W. Sh., I. 79, Fig. 139 (1869).

Helix patula, DESHAYES, Encycl. Méth., II. 217 (1830).

Anguispira perspectiva, TRYON, Am. Journ. Conch., II. 262 (1866).

A Post-pleiocene species; north of Maryland it is not now found east of the Appalachian chain, but elsewhere is probably found over the whole of the Eastern Province.

Animal: head and eye-peduncles bluish-black; margin and posterior part of foot white. Foot transparent, narrow, less in length than twice the diameter of the shell, terminating acutely.

The jaw and lingual membrane are quite like those of *P. striatella*. The ends of the jaw, however, are more squarely truncated, and the striæ are not converging.

Lingual membrane (Pl. IV. Fig. A); 15—1—15 teeth, 7 perfect laterals.

The genitalia are figured by Leidy (Vol. I. Pl. VII. Figs. 4-7). The same general arrangement is found as in *alternata*, but all the organs are more elongated; the duct of the genital bladder is very long and thread-like.

Patula striatella, ANTHONY.

Vol. III. Pl. XXX. Fig. 2.

Shell umbilicated, orbicularly convex, thin, brownish horn-color, with crowded ribs; whorls 4, scarcely convex, the last inflated below, rather wide; umbilicus large, pervious; aperture subcircular; peristome simple, acute, its terminations approached. Greater diameter 6, lesser 5½ mill.; height, 3 mill.

Helix striatella, ANTHONY, Bost. Journ. Nat. Hist., III. 278, Pl. III. Fig. 2 (1840). — BINNEY, Bost. Journ. Nat. Hist., III. 432, Pl. XXI. Fig. 5 (1840); Terr. Moll., II. 217, Pl. XXX. Fig. 2. — GOULD, Invert. 178, Fig. 112 (1841). — ADAMS, Vermont Mollusca, 162 (1842). — DEKAY, N. Y. Moll., 43, Pl. III. Fig. 40 (1843). — CHEMNITZ, 2d ed., II. 115, Tab. LXXXV. Figs. 36-38. — PFEIFFER, Mon. Hel. Viv., I. 104. — REEVE, Con. Icon., 727 (1853). — W. G. BINNEY, Terr. Moll., IV. 99. — MORSE, Amer. Nat., I. 545, Fig. 40 (1867). —

W. G. Binney, L. & Fr.-W. Sh., I. 80, Fig. 140 (1869). — Gould and Binney, Inv. of Mass., ed. 2, 413 (1870).

Helix ruderata, Adams, Sill. Journ. [1], 40, 408, not Studer.

Helix Cronkheiti, Newcomb, Proc. Cal. Acad. Nat. Sci., III. 180 (1865).

Patula striatella, Morse, Journ. Portl. Soc., I. 21, Fig. 48, Pl. II. Fig. 6; Pl. VIII. Fig. 49 (1864).

Anguispira striatella, Tryon, Am. Journ. Conch., II. 262 (1866).

Patula Cronkheiti, Tryon, Am. Journ. Conch., II. 263 (1866).

This is a species of the Northern Region, being found through British America, at Great Slave Lake, etc., Canada, New England, and extends to Virginia and Kansas. It has also been found in Arizona, Hell Gate River, Idaho, in the Central Province, and has been quoted from the Pacific Province. It may therefore prove to be universally distributed.

Jaw arcuate, ends attenuated; anterior surface with converging striæ; concave margin irregularly notched, no median projection (p. 154, Fig. 61).

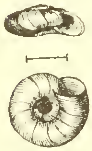
Lingual membrane with 100 rows of 16—1—16 teeth (Morse). The lingual examined by me (Pl. IV. Fig. B) has 20—1—20 teeth, with 8 perfect laterals.

Animal: head, neck, and eye-peduncles dusky; foot white.

Genitalia unobserved.

As regards *P. Cronkheiti*, I am not able to decide about its specific distinction from *striatella*. Specimens have been sent me under this name from Ounalaska, from Klamath Lake, and various localities in the Pacific and Central Provinces, one of which is here figured.

Fig. 76.



P. Cronkheiti

This species bears a very strong resemblance, in general aspect, to *perspectiva*, with the immature shells of which it is very commonly confounded. It needs some attention to separate the two; but when the present species is once noticed, it cannot fail to be considered very distinct. Its discriminative characters, as compared with the former species, are as follows: The mature shell is smaller, and has generally rather less, and never more than 4 whorls; and in shells of the same size the number of volutions is less. It is thinner and more delicate; its color is lighter; its striæ of increase are more numerous, more oblique, much finer, and less prominent; its suture is less deeply impressed; its spire is more convex, and its umbilicus less expanded. The character of the epidermis is the same in both. The lustre of the epidermis resembles that of satin.

Whiteaves (Can. Nat., VIII. 56) says it has been suggested that *striatella* is identical with *H. omphalos*, Searles Wood, an Eocene fossil of Headon Hill, Isle of Wight.

Patula pauper, Gould.

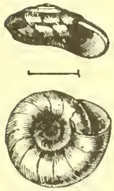
Shell small, discoidal, reddish horn-colored, with incremental ribs, below chalky; whorls $4\frac{1}{2}$, rather convex; suture deep; aperture very oblique, falling forward. Diameter, $\frac{3}{10}$; axis, $\frac{1}{8}$ poll. (Gould.)

Hyalina pauper, Gould, Pr. Bost. Soc. N. H., VI. 423; Otia, 102.

An Asiatic species, found also in Alaska, if I am right in referring to it the Ounalaska specimens called *ruderata* by Dr. Cooper (Am. Journ. Conch., V. 202).

The specimen figured was collected by Dr. Dall at Petropaulauski.

Fig. 77.

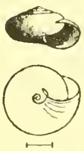


P. pauper.

Patula Horni, Gabb.

Shell umbilicated, globosely depressed, thin, coarse, reddish horn-color, under the epidermis obliquely striate, hirsute; whorls 4, scarcely convex, the last inflated below; umbilicus pervious, showing the whorls to the apex; aperture oblique, subcircular; peristome simple, acute, its ends hardly approaching, that of the columella not widened, nor reflected. Greater diameter, 4, lesser, $3\frac{1}{3}$ mill.; height, 1 mill.

Fig. 78.



P. Horni.

Helix Hornii, Gabb, Am. Journ. Conch., II. 330, Pl. XXI. Fig. 5 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 81, Fig. 143 (1869).

Hyalina Hornii, Tryon, Am. Journ. Conch., III. 163 (1867).

Fort Grant, Arizona, at the junction of the Arivapa and San Pedro Rivers, in the Central Province.

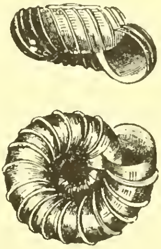
My description and figure are drawn from an authentic specimen.

Animal not examined.

Patula asteriscus, Morse.

Shell widely umbilicated, orbicularly depressed, light brown, decussated by delicate incremental and revolving striæ and with from 25 to 30 delicate, thin, transparent, prominent ribs, with waving edges and inclined backwards, more like the epidermis than the texture of the shell; whorls 4, the upper ones flattened, the last globose; suture deeply impressed; aperture subcircular; peristome simple, acute, its columellar extremity subreflected. Greater diameter, $1\frac{1}{2}$ mill.; height, $\frac{1}{2}$ mill.

Fig. 79.



P. asteriscus, enlarged.

Helix asteriscus, Morse, Proc. Bost. Soc., VI. 128 (1857). — W. G. Binney, Terr. Moll., IV. 103, Pl. LXXVII. Fig. 9; L. & Fr.-W. Sh., I. 82, Fig. 145 (1869). — Bland, Ann. N. Y. Lyc., VIII. 163, Fig. 8. — Morse, Amer. Nat., I. 546, Fig. 43 (1867). — Gould and Binney, Inv. of Mass., ed. 2, 415 (1870).

Planogyra asteriscus, Morse, Journ. Portl. Soc., I. 24, Figs. 50–52, Pl. II. Fig. 5; Pl. VIII. Fig. 53 (1864). — Tryon, Am. Journ. Conch., II. 263 (1866).

From Gaspé to the north of Lake Superior, and through New England; it may therefore be considered a species of the Northern Region.

The animal is described by Morse as bluish-white, with head, neck, and eye-peduncles mottled by streaks and dots of bluish-black; disk yellowish-white.

Jaw but slightly arcuate, of uniform width throughout, long, narrow, ends blunt; anterior surface with coarse striæ, not modifying the concave margin, which has an obtuse, wide, slight median projection (p. 154 Fig. 61).

Lingual membrane (Pl. IV. Fig. C). Morse gives 77 rows of 13—1—13 teeth; 6 perfect laterals. I counted 11—1—11, with 5 perfect laterals. The reflected portion of the central teeth is quite small. The marginal teeth are like those of *Pupa*.

Genitalia not examined.

Doubtful Species of Patula.

Patula Mazatlanica. I do not believe this species can really exist at Lone Mountain, San Francisco County, California, as asserted. See L. & Fr.-W. Sh., I. 82.

Patula incrustata is a *Microphysa* (q. v.), as is also

Patula vortex (q. v.).

Helix tenuistriata, Binney, is also a *Patula*. It is an unknown species. The following description is copied from manuscript of Dr. Binney: —

Shell flattened, the upper surface acutely carinated; epidermis light horn-color; whorls 7, narrow, increasing in width very gradually from the apex to the aperture; striated with fine, prominent, distinctly separated, curved lines; aperture angular, depressed, contracted; peristome above the carina acute, below a little reflected; base subconvex, smooth; umbilicus open, moderate in size, exhibiting 2 or 3 volutions. Greatest transverse diameter about ½ an inch.

Found hitherto only in the eastern part of Tennessee, whence a single specimen was brought by Mr. Haldeman. This pretty species is described with some reluctance from a single specimen, as it may be considered doubtful, until another be found, whether it may not be a foreign shell introduced by mistake among Tennessean shells. It is quite flat on the upper surface, rising a little towards the apex; the whorls, which are distinctly marked, are beautifully striated with delicate prominent curved lines, which are crowded towards the apex, and separated by a distinct interval on the outer whorl; they terminate on the edge of the carina, which is a little plaited by them, the base below being smooth. The aperture is narrow, and marked by an angle at the carina. The lip below the carina has a distinct, though narrow reflection. The umbilicus is moderate, conical, and rather deep, exhibiting about three volutions. In Lamarck's arrangement it would be a *Carocolla*.

Helix tenuistriata, Binney, Bost. Journ. Nat. Hist. 1842, IV. Part I. cover, p. 3. — Pfeiffer, Mon. Hel. Viv., I. 432. — W. G. Binney, Terr. Moll., IV. 118; L. & Fr.-W. Sh., I. 77 (1869).

Helix vortex, teste Gould (non Pfeiffer), Terr. Moll., III. 34.

Helix limitaris, G. M. Dawson. — Land and Fresh-Water Mollusca, collected during the summers of 1873, 1874, in the vicinity of the 49th parallel. Lake of the Woods to the Rocky Mountains; British North American Boundary Commission; Report on the Geology, etc. Montreal: 1875. pp. 347–350. I have seen young individuals kindly sent me by Mr. Dawson, and suspect them to be immature individuals of some variety of *P. strigosa.* The original description here follows: —

Shell conspicuously umbilicated, globosely depressed, solid, coarse; whorls carinate at the periphery and subcarinate near the umbilicus, giving the mouth a distinctly rhomboidal form in young specimens; peripheral carination almost obsolete on the last half whorl; aperture roundedly lunate, very oblique, slightly reflexed at the umbilicus, so as to interfere somewhat with its circular outline; peristome acute, thickened within; callus delicate, transparent; whorls 5½; suture slightly impressed, becoming more distinct in the last half whorl; surface marked with coarse transverse wrinkles and faint revolving lines, the latter scarcely perceptible on the outer whorl; color, dull yellowish, with four brownish revolving bands, two of which appear pretty constant, and are situated on each side of the peripheral carina, which is generally whitish; the two remaining bands near the suture and umbilicus respectively, fainter and less constant. Animal resembles *H. solitaria* in general form, pale, with brownish spots. Greatest diameter 17 mill.; least diameter 14 mill.; height 11 mill. Young specimens only 4 mill. in diameter are very strongly carinated, and flattened above; semi-transparent, brownish-tawny in color; delicately marked with close revolving and transverse lines.

This shell is closely allied to *Helix solitaria*, but is smaller, darker-colored and rougher, more distinctly carinated, especially in young specimens; the shell is also somewhat thicker, the umbilicus is narrower, and the lip encroaches slightly on its circular outline. Loc. Waterton Lake. Rocky Mountains.

MICROPHYSA, Albers.

Animal as in *Patula.*

Shell umbilicated, depressed, thin, delicately striate, scarcely shining; spire flattened; suture distinct; whorls 4–5, rather convex, gradually increasing, the last not descending; aperture roundly lunate; peristome thin, perfectly simple, its extremities converging.

A West-Indian genus. Two of its species have been introduced into the Southern Region. One indigenous species has, however, been found in the Central Province and one in the Pacific Province.

The jaw was supposed to be ribless, and hence the position of the genus in the systems; I retain it here, though I have found that it has numerous, flat, broad, crowded ribs. In *M. turbiniformis* (Ann. Lyc. Nat. Hist. of N. Y., X. 79, Pl. II. Fig. 2) the ribs seem to be of the character common in *Bulimulus, Cylindrella*, etc. (See p. 44.)

Lingual membrane of *vortex, turbiniformis, incrustata, Lansingi*, and *Ingersolli* only known. The base of attachment of the centrals and laterals is peculiarly quadrate; both have decided side cusps and cutting points. The change into the marginals is made in *Ingersolli* and *incrustata* without the splitting of the inner cutting point, but it is otherwise in *vortex* and *turbiniformis*. The marginals are low, wide, the inner cutting point is long, blunt, simple in *Ingersolli* and *incrustata*, bifid in the other species. The outer cutting points of all are short, varying in number from 1 to 3.

Thus in this genus, as in most of the others, we find a certain range of variation in the dentition and jaw.

From the above comparisons I have omitted *M. Lansingi*, whose puzzling combination of jaw and marginal teeth is described below.

Microphysa incrustata, Poey.

Vol. III. Pl. XXIX. a, Fig. 4.

Shell umbilicated, depressed, smooth, horn-colored, usually incrusted with dirt, with crowded striæ; spire slightly elevated, composed of 4 or 5 well-rounded whorls separated by a deeply impressed suture; beneath with a broad umbilicus, one third the diameter of the shell, exhibiting all the whorls within; aperture circular, being but slightly impinged upon by the penult whorl, its extremities joined by a slightly appressed scale of enamel, rendering the peristome continuous; peristome slightly reflexed, so as to render the aperture somewhat campanulate. Greater diameter $4\frac{2}{3}$, lesser 4 mill.; height, 2 mill.

Helix incrustata, Poey, Memorias, I. 208, 212, Pl. XII. Figs. 11–16. — Pfeiffer, Mon. Hel. Viv., III. 632. — W. G. Binney, Terr. Moll., IV. 68, L. & Fr.-W. Sh., I. 70, Fig. 117 (1869).

Helix saxicola, Gould in Terr. Moll., II. 174, Pl. XXIX. a, Fig. 4, not Pfeiffer.

Helix incrassata, Reeve, Con. Icon., 972.

Pseudohyalina incrustata, Tryon, Am. Journ. Conch., II. 265 (1866).

Galveston and Corpus Christi, Texas. Also near Havana, Cuba. It must be considered a species of the Southern Region.

Its circular, campanulate aperture, almost disconnected with the preceding whorl, is one of its most striking peculiarities.

Jaw low, wide, slightly arcuate, ends blunt, but little attenuated; anterior surface with numerous crowded ribs, bluntly denticulating the lower margin.

Lingual membrane with 13—1—13 teeth, of which 5 are perfect laterals. Centrals quadrate, tricuspid; laterals like centrals, but bicuspid; marginals low, wide, with one inner long, blunt, and several short, side, blunt cutting points (Pl. III. Fig. S).

I formerly placed this species in *Patula*, but, having recently examined the jaw of a dried specimen in my cabinet (collected over thirty years ago at Galveston), I am led to believe that Von Martens is right in placing it in *Microphysa*.

Microphysa vortex, Pfr.

Vol. III. Pl. XLVIII. Fig. 2.

Shell umbilicated, depressed, pale bluish-white, pearly, very thin, transparent; whorls 5, prominent, with exceedingly minute, oblique striæ of increase; suture deeply impressed; base somewhat convex; axis open, umbilicus infundibuliform; aperture flattened-transverse; peristome thin, acute, not reflected. Greater diameter 6, lesser 5½ mill.; height, 2¾ mill.

Helix vortex, Pfeiffer, Arch. f. Nat. 1839, II. 351; Mon. Hel. Viv., I. 95. — Chemnitz, ed. 2, II. 110, Pl. LXXXVIII. Figs. 7 – 9. — Reeve, Con. Icon., 644 (1852). — Gould, Terr. Moll., III. 34. — W. G. Binney, Terr. Moll., IV. 117; L. & Fr.-W. Sh., I.

Helix selenina, Gould, Bost. Proc., III. 38 (1848); in Terr. Moll., II. 240, Pl. XXIX. a, Fig. 2; Pl. XLVIII. Fig. 2. — Reeve, Con. Icon., 716 (1862).

Hyalina vortex, Tryon, Am. Journ. Conch., II. 252 (1866).

Florida Subregion; Southern Florida and the adjacent islands, introduced from the West-Indian fauna.

The species is apparently viviparous, Fig. 116 of Land and Fresh-Water Shells, I., representing an embryonic shell taken from an adult by Mr. Morse.

This small species does not exceed *Zonites arboreus* in size. Its transparency is greater than that of any other of our species. The general character of its upper surface is that of depression; but though the whorls revolve in nearly the same plane, the suture is so deeply impressed that each whorl is rendered convex or tumid. The umbilicus is of small diameter, but well defined and deep. The aperture is transverse, and flattened in its vertical diameter; the peristome is thin, sharp, and not turned outwards. The convexity of the base being greater than that of the upper surface, an obtuse angle is sometimes produced on the periphery of the shell at the line of their junction, which is more or less prominent in different specimens.

Jaw not observed.

Lingual membrane (Pl. III. Fig. T): 18—1—18 teeth, with 8 laterals. The sixteenth marginal tooth is shown.

Microphysa Lansingi, Bland.

Shell[1] imperforate, orbicular-depressed, shining, dark horn-colored, smooth above, at the base substriate; suture impressed; whorls 5½, rather convex, the last not descending, obsoletely angular at the periphery, more convex at the base, excavated around the umbilical region; aperture narrow, lunate; peristome acute, the right margin thickened within by an obsoletely denticulated lamella, columellar margin scarcely reflected. Greater diameter scarcely 3, lesser 2½ mill.; height, 1⅓ mill. (Bland.)

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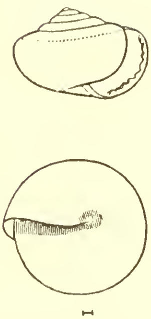
[1] T. imperforata, orbiculato-depressa, fusco-cornea, superne lævigata, basi substriatula; sutura impressa; anfr. 5½ convexiusculi, ultimus non descendens, ad peripheriam obsolete angulatus, subtus convexior, circa regionem umbilicarem excavatus; apertura anguste lunaris; peristomate acuto, margine dextro lamella obsolete serrata intus incrassato, columellari vix reflexiusculo.

Fig. 80.



Microphysa Lansingi.

Zonites Lansingi, Bland, Ann. Lyc. Nat. Hist. of N. Y., XI. 74, Fig. 1. 2 (1875).

In damp moist places, among leaves. Astoria, Oregon, in the Oregonian Region.

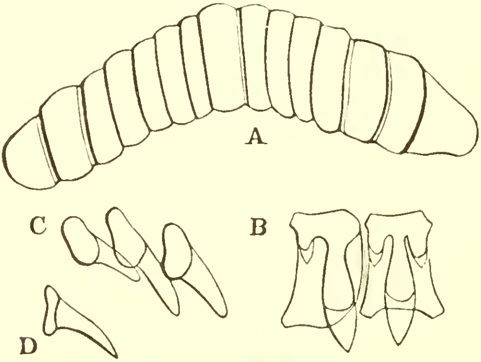
The aspect of the upper surface of the shell is very like that of *Z. multidentatus* (Binney).

Mr. Bland places the species in *Zonites*, but, owing to the character of the jaw, I am inclined to consider it a *Microphysa.*

One specimen of *Lansingi*, appearing to have the animal within it, was crushed between two glass slides, enabling me, without the use of potash, satisfactorily to observe the jaw and teeth remaining uninjured in the tissues of the animal.

Jaw low, wide, slightly arcuate; ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with 14 broad, unequal, crowded, flat ribs, slightly denticulating either margin. The first impression given by the jaw is that it bears narrow, separated ribs, as in *Bulimulus*, *Cylindrella*, etc. A more careful study of it, however, shows the ribs to be very broad, crowded, flat, with narrow interstices between them.

Fig. 81.



Jaw and teeth of *M Lansingi.*

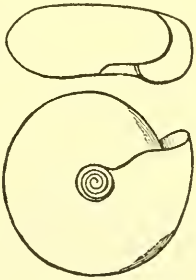
Lingual membrane with 17—1—17 teeth; 6 laterals. Centrals (Fig. B) with the base of attachment longer than wide, the lower lateral angles expanded; upper margin broadly reflected; reflection very short, tricuspid; side cusps decidedly developed, short, bearing distinct cutting points; median cusp long, slender, bulging at sides, reaching nearly to the lower edge of the base of attachment, beyond which projects slightly the long, distinct cutting point. Laterals like the centrals, but asymmetrical by the suppression of the inner lower angle of the base of attachment, and inner side cusp and cutting point. Marginals (C) aculeate, their bases of attachment less sole-like than in *Zonites*, but more circular in outline. Fig. C shows these bases of attachment. Fig. D gives one marginal tooth in profile.

This is the first known instance of a species with ribs on its jaw having aculeate marginal teeth, or of a species furnished with a *Zonites*-like shell having decided ribs upon the jaw. It will be difficult to find a place for the species under any description of genus or subfamily. The shell is that of *Zonites*, but that genus has a ribless jaw with median projection. It will be seen that its ribbed jaw and aculeate marginal teeth do not sustain my assertion (p. 47) that for the larger divisions these organs may be relied on as systematic characters. The result of my examination of this species was as unexpected as it is puzzling.

Microphysa Ingersolli, BLAND.

Shell[1] umbilicated, discoidal, thin, translucid, nearly smooth, white; spire flat, summit subimmersed; suture impressed; whorls 5½, rather convex, slowly increasing, the last not descending, more convex below the periphery; breadth of umbilicus nearly 1 mill.; aperture subvertical, higher than broad, lunate; peristome simple, acute, margins remote, columellar margin slightly reflexed, basal margin subsinuate. Greater diameter 4, lesser 3⅔ mill.; height, 2⅓ mill. (Bland.)

Fig. 82.



Microphysa Ingersolli, enlarged.

Helix Ingersollii, BLAND, Ann. Lyc. Nat. Hist. of N. Y., XI. 151, Fig. (1874). — INGERSOLL, Special Rep. on Recent Moll. of Colorado, ed. 2, 1876, p. 397.

A species of the Central Province. Howardsville, Baker's Park, 9,300 feet above the sea, abundant in wet places on the mountains; not uncommon at Cunningham Gulch, near the former locality, clinging to the almost vertical face of a trachyte cliff, at an elevation of about 11,000 feet; the finest specimens came from this spot; found also on the southern slope of the Saguache Mountains, in the Las Animas and La Plata Valleys, in the same stations as affected by *Succinea*. All the localities mentioned are in the southwestern corner of Colorado.

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[1] T. umbilicata, discoidea, tenuis, translucida, sublevis, alba; spira plana, vertice subimmersa; sutura impressa; anfr. 5½, convexiusculi, lente acrescentes, ultimus non descendens, infra peripheriam convexior; umbilicus fere 1 mill. latus; apertura subverticalis, altior quam lata, lunaris; perist. simplex, acutum, marginibus remotis, columellari brevissime patente, basali subsinuato.

This species was discovered by Mr. Ernest Ingersoll, Naturalist of the United States Geological Survey of the Territories, under Professor Hayden. It can scarcely be compared with any known North American species.

At first sight I was disposed to consider the species a *Zonites*, but examination of the animal proved it to belong to the *Helicea*.

Jaw low, wide, slightly arcuate, ends slightly attenuated; whole anterior surface with about 22 broad, flat, slightly separated ribs, whose ends denticulate either margin.

Lingual membrane long and narrow. Teeth about 16—1—16. Centrals as usual in the *Helicea* (Pl. III. Fig. V). The side cusps and cutting points are well developed, the base of attachment longer than wide. Laterals of same type, but asymmetrical, and consequently only bicuspid. The change from laterals to marginals (8th and 9th teeth of figure) is very gradual, there being no splitting of the inner cutting point. Marginals (16th tooth of figure) very low, wide, with one inner, long, blunt cutting point, and one outer, small, blunt. The low, wide marginal teeth of this species are peculiar.

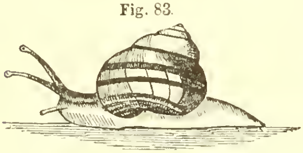
SPURIOUS SPECIES OF MICROPHYSA.

Microphysa minuscula of Von Martens (Alb., ed. 2) is a *Zonites* (q. v.).

HEMITROCHUS, SWAINSON.

Animal heliciform (of *H. varians*), stout, anteriorly blunt, posteriorly long, acutely terminating; mantle central, thin, simple, protected by a shell; no distinct locomotive disk; no caudal mucus pore; respiratory and anal orifices subcentral, on the right side of the mantle, under the peristome of the shell; generative orifice not observed, probably behind the right eye-peduncle.

Fig. 83.



Animal of *H. varians*.

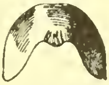
Shell external, with the perforation open or closed, globose, shining; spire short; whorls 4 – 5, the last large, deflexed at the aperture; columella dilated at the base; aperture contracted, subvertical, roundly lunate; peristome simple, obtuse, labiate within, its margins distant.

A West-Indian genus; one species has been introduced into the Florida Subregion.

In Ann. Lyc. N. H. of N. Y., X. 341, I have, in connection with my friend Mr. Bland, shown the necessity of using this name in preference to *Polymita*. I will here simply repeat that the type of the latter genus is *muscarum*, Lea, from which the other species formerly associated with it differ generically in dentition. They will therefore be known by the first published name, *Hemitrochus*.

The jaw is strongly arched with acuminated ends, smooth anterior surface, and decided median prominence to cutting margin. Fig. 84 represents the jaw of *varians*. The other West-Indian species examined by me have the same type of jaw.

Fig. 84.



Jaw of *H. varians.*

The lingual membrane (Pl. IV. Fig. L) has about 33—1—33 teeth; another specimen gave 43—1—43 teeth, with 17 perfect laterals. The central tooth has a long, narrow base of attachment with lower, outer angular expansions and incurved lower margin. The reflected portion is only about one half the length of the base of attachment, is short, and bears one short, stout cusp with an equally short, stout cutting point; the side cusps and cutting points are obsolete. The laterals are the same as the centrals, but asymmetrical. The outer laterals, commencing at the 11th, have a side cusp and cutting point; the inner cutting point is bifid on the 16th tooth; after this the change into the marginals is rapid. The marginals are low, wide, and have one broad, long, oblique, bluntly bifid cutting point, the inner division the smaller, and a very much shorter side cutting point. This side cutting point is also sometimes bluntly bifid in the extreme marginal teeth.

The dentition of the other species of this genus, extralimital to North America, examined by me, agrees with that of this species. (See Pr. Phila. Ac. Nat. Sc. 1874, 56.)

Hemitrochus varians, MENKE.

Vol. III. Pls. XLVI., XLVII.

Shell subimperforate, of medium size, solid, conic-globose, delicately striate, but leaving the surface smooth and shining; the ground-color is variable, being white, dusky, greenish or reddish, and either plain or variously encircled by dark bands; the apex and the peristome, especially the columellar portion, is always rose-red, and generally, likewise, the throat; the spire is elevated, composed of about 5½ convex whorls, the outermost broadly rounded at the periphery; the base is moderately convex and perforated by a minute umbilicus, nearly covered by the expanded and flattened peristome; aperture small, approaching two thirds of a circle; peristome acute, thickened within, a little everted, becoming more so towards its inner junction. Greater diameter 19, lesser 17 mill.; axis, 15 mill.

Helix varians, MENKE, teste PFEIFFER. — PFEIFFER, Mon. Hel. Viv., I. 238; in CHEMNITZ, ed. 2, II. 221, Pl. CIX. Figs. 1-5. — W. G. BINNEY, Terr. Moll., IV. 51, Pl. LXXVIII. Fig. 22. — L. & Fr.-W. Sh., I. 184 (1869).

Helix carnicolor, PFEIFFER, Symb., I. 37. — DESHAYES in FÉR., I. 205, Pl. XXIX. A, Figs. 14-17. — REEVE, Con. Icon., No. 283 (1852).

Helix Pisana, PFEIFFER in CHEMNITZ, IX. Part 2, 139, t. CXXXII. Fig. 1186, 1187. — FÉRUSSAC, Hist. l. c. ? — Not of MÜLLER.

Helix submeris, MIGHELS, Bost. Proc., I. 187 (1844). — PFEIFFER, Mon. Hel. Viv., III. 183.
Helix rhodocheila, BINNEY (formerly), Terr. Moll., I.
Hemitrochus hæmastomus, SWAINSON, Malac. 165, Fig. 19?
Helix polychroa, BINNEY, Terr. Moll., II. 123, Pls. XLVI., XLVII.
Polymita varians, TRYON, Am. Journ. Conch., II. 321 (1866).

A species of the West-Indian fauna, common on New Providence; found also in the Florida Subregion on the Keys, Key West, Key Biscayne, Cape Florida.

Animal (see Vol. IV. Pl. LXXVIII. Fig. 22): body of a delicate white color, very finely granulated; eye-peduncles rather long; a dark line arising between the eye-peduncles and along the back passes under the shell; a fainter line is found along each side of the neck.

Among the varieties the following may be enumerated: —

α. Elevated, white with a median black band on the outer whorl, which is sutural on the spire margined with pale citron.

β. The same, with two approximate black basal bands.

γ. Elevated, white with two narrow bands on the outer whorls, one of which is median, the other sutural on the spire, the latter interrupted.

δ. The same, with a broad basal fascia.

ε. Yellowish, with numerous bands partially blended by dusky lines in the direction of the increment.

ζ. Fuliginous, with a single white peripheral fascia and white umbilical area. (This variety was described by Dr. Mighels under the name of *H. submeris*.)

η. Depressed, ashy-olive, with a white peripheral band.

θ. Elevated, uniform yellowish green.

ι. Uniform pale reddish.

For jaw and dentition, see above, p. 174.

Genitalia not examined.

HOLOSPIRA, MART. & ALB.

Animal unknown.

Shell rimate, turreted or fusiform, apex conical, not truncated; whorls 11 – 14, the last not at all or but slightly protracted, carinated at base; columella plicate; aperture quadrangular; peristome free, expanded.

A Mexican genus, extending into the Texan Subregion.

It was formerly considered a subgenus of *Cylindrella*, but now is known to widely differ in jaw and dentition.

There are two species of this genus found within our limits, *H. Goldfussi* and *Roemeri*. I have not been able to examine the lingual membrane of *H. Roemeri*, but, thanks to Mr. Bland, I have examined and figured (Pl. IV. Fig. N) that of *H. Goldfussi*. There are 26—1—26 teeth, with about 9 laterals. The cusps of the marginals are quite widely separated. The general characters of the teeth are as described below. I can refer also to Messrs. Fischer and

Crosse for information regarding the jaw and dentition (Journ. de Conch., XVIII. 13, 1870, Pl. V., and Moll. Mex. et Guat., 320, Pl. XVI.).

The lingual membrane in *H. Tryoni* and *Pfeifferi*, examined and figured by those authors, is of the same type. The centrals and laterals have a single short cusp, bearing a short, blunt cutting point, both side cusps and side cutting points being absent; marginal teeth a simple modification of the laterals, which pass very gradually into them, quadrate, wide, low, with one long, inner, obtuse cutting point, and one outer, side, short, blunt cutting point.

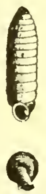
The jaw is arcuate, with slightly acuminated, blunt ends, thin, anterior surface ribless; cutting edge simple; transversely and vertically striated.

Holospira Roemeri, Pfr.

Shell scarcely rimate, subcylindrical, with an obtusely conic non-truncated spire, substriate, light flesh-colored; whorls 14, narrow, rather flattened, the last carinated at base, separated from the shell and twisted; aperture vertical, oblong, circular, within narrowed by a fold on its right margin; peristome continuous, equally and briefly expanded. Length 13 – 14, diameter $4\frac{1}{2}$ mill.; ap. 3 mill. long, $2\frac{1}{2}$ broad.

β. Smaller, more ventricose above; whorls 12, the last more briefly loosened. Length, 11 mill.; diameter above the middle, 4 mill.

Fig 85



H. Roemeri.

Cylindrella Roemeri, Pfeiffer, Mon. Hel. Viv., II. 383; in Roemer's Texas, 456; in Chemn., ed. 2, No. 81, Pl. VII. Figs. 4 – 6. — W. G. Binney, T. M., IV. 150; L. & Fr.-W. Sh., I. 24, Fig. 18 (1869).

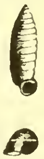
Holospira Roemeri, Tryon, Am. Journ. Conch., III. 312 (1868).

New Braunfels and Howard Springs, Texas. It has not been noticed outside the Texan Subregion.

Holospira Goldfussi, Menke.

Shell umbilicated, elongated, more ventricose at the middle, apex conic, not truncated, thin, diaphanous, light horn-color, marked with numerous light, subarcuate striæ; whorls 12, scarcely convex, narrow, the last slightly extended beyond the body of the shell, carinated, its right side somewhat furrowed, rounded at base; aperture subvertical, obliquely and subtriangularly pear-shaped; peristome slightly expanded at its entire circumference, its right termination flexuose. Axis with revolving lamella, and also with a curious one on the under side of the septum of the third whorl from the base. Length, 11 mill.; diameter, $4\frac{1}{3}$ mill.

Fig. 86.



H. Goldfussi.

Cylindrella Goldfussi, Menke, in Zeitsch. f. Mal. 1847, III. 2. — Pfeiffer, Mon. Hel. Viv., II. 383. — Phillippi, Icon., III. 6, Tab. III. 9 (1847). —

W. G. Binney, T. M., IV. 151, Pl. LXXIX. Fig. 33; L. & Fr.-W. Sh., I. 24, Fig. 19 (1869).

Holospira Goldfussi, Tryon, Amer. Journ. Conch., III. Pl. XV. Fig. 31 (1869).

Texas, on the Blanco; a species of the Texas Subregion.

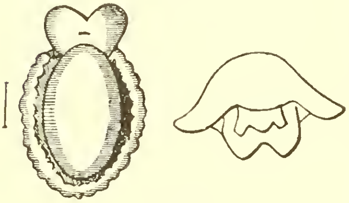
In the penultimate whorl of *Goldfussi* there are 4 lamellæ: one strongly developed, situated on the under side of the upper septum, and in length about equal to one half of the circumference of the whorl; another on the upper surface of the lower septum, immediately beneath and opposite to the above-mentioned lamella, and of about equal length, but not so much developed; a third lamella on the middle of the lower half of, and revolving on, the axis; the fourth on the inner side of the outer wall of the shell (opposite the axial lamella), and visible from the exterior.

For lingual membrane and jaw, see p. 176.

ONCHIDELLA, Gray.

Animal limaciform; body oblong or oval; mantle covering the whole body and reflected under the body, smooth or granular, without tufts or radiating processes on the dorsal surface; foot broad, simple posteriorly; oral appendages lobate, simple, undivided; tentacles none; eyes at the end of long, club-shaped retractile peduncles. Respiratory orifice posterior, at the right side. Anal orifice separate, posterior; male organ under the right eye-peduncle, female orifice at the posterior extremity of the body. No caudal mucus pore. No distinct locomotive disk, though the reflection of the mantle on either side of the foot gives a tripartite appearance to the under surface of the body.

Fig. 87.



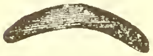
O. borealis.

Shell none.

In three specimens of *O. borealis* examined I found a jaw (Fig. 88), low, wide, slightly arcuate, ends scarcely attenuated, blunt, anterior surface ribless.

Lingual membrane (Pl. V. Fig. B) long and wide. Teeth about 61—1—61, arranged strongly *en chevron*. The central tooth is large, longer than wide, truncated above, expanded below its middle, and incurved at the basal margin. The reflection is large, tricuspid, each cusp bearing a decided cutting point. The side teeth have a long, narrow base of attachment, a small part of its upper portion thrown outwards, the balance curving inwards, giving an irregular bow-shape to the whole base of attachment, — whose upper and lower edges are abruptly truncated. The reflection is near the base, and consists of a very

Fig. 88.



Jaw of *O. borealis*.

small, inner cusp, bearing a small conical cutting point, and another, outer, larger cusp, bearing an extraordinarily developed, wide, expanding, bluntly truncated cutting point. As the teeth pass outwards towards the outer margin of the membrane, they at first increase and then decrease in size, but retain the same shape quite to the edge.

The dentition of several Eastern species has also been published.

The *Onchidiidæ* are described as agnathous, but I am confident of having observed the jaw figured. I found none in *Onchidium Schrammi* (see Ann. Lyc. Nat. Hist. of N. Y., X. 339).

Onchidella borealis, Dall.

Animal small, black, with dots and streaks of yellowish white, foot light colored, also muzzle and tentacles. Back regularly rounded, but a little pointed in the middle; smooth or very finely granulose, tough, and coriaceous. Eyes globular, blue, on very short constricted tentacles. Muzzle short, rounded-transverse. Head not produced beyond the anterior edge of the mantle. Sexual appendages on the right side, near the head. Foot ovate, narrow, rather roundly pointed behind. Lon., .3 in. *Hab.* Sitka, Alaska Territory, on the rocks near tide-marks, especially on the small islets in the Bay. (Dall.)

Onchidella borealis, Dall, August, 1866, Am. Journ. Conch., VII. 135.

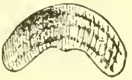
Found from Prince William's Sound to Vancouver's Island, by Mr. Dall, to whom I am indebted for specimens, one of which is figured on p. 178.

For jaw and lingual membrane see above.

TEBENNOPHORUS, Binn.

Animal limaciform. Body somewhat flattened, terminating obtusely, or in a somewhat truncated form, obtuse anteriorly. Back convex, more flat when fully extended. Integuments with irregular vermiform glands, anastomosing with each other, and having a general longitudinal direction. Mantle covering the whole body. Foot expanded at its margin, and visible beyond the sides of the mantle; no locomotive disk. Respiratory orifice near the head, some way to the rear of the right eye-peduncle. Anal orifice contiguous to, and a little above and in advance of the pulmonary orifice. Orifice of organs of generation behind and below the right eye-peduncle. Without terminal mucus pore. No external or internal shell.

Fig 89.



Jaw of *Tebennophorus Carolinensis.*

Jaw horn-colored, arcuate, with irregular concave margin, bearing a blunt, slightly projecting beak; terminations blunt; the anterior surface convex, without a decided median carina, and strongly striate.

The genus is not peculiarly American, as it is also found in Asia. In North

America it ranges over the whole Eastern Province, in Mexico and into Central America.

The internal rudimentary, nail-like shell described by Dr. Gray has not been noticed by any American author.

The habits of the genus are similar to those of the native species of *Limax*.

This genus was first described, in 1842, by Dr. Binney (Bost. Journ. Nat. Hist., IV. 163), under the name of *Tebennophorus*. No other descriptions of it had then been published. The species of it have been referred by various authors to other genera, such as *Limax*, which differs in having a small shield-like mantle, a different shaped jaw, etc.; and to *Philomycus*, a genus distinguished by the absence of a mantle. The latter genus probably existed only in the fertile imagination of Rafinesque, the same "habitat" where flourished *Tremesia* and *Deroceras*.[1]

Férussac repeats (1823) the description of Rafinesque, but never had seen an individual of the genus. He suggests that *Limax Caroliniensis*, Bosc, may belong to it, judging from the figure alone. Gray, H. and A. Adams, and Mörch adopt the name of *Philomycus*, on the supposition that Rafinesque had before him a *Tebennophorus* when describing *Philomycus* (in 1820). It may be he had, but as he did not make it so appear, I have preferred adopting the first name evidently applying to it.

Meghimatium, or *Incillaria*, an Asiatic genus, is identical with *Tebennophorus*.

One species only is known to exist within our limits, *T. Caroliniensis*. It has an arched jaw (Fig. 89), with blunt, scarcely attenuated ends, ribless anterior surface, and decided blunt median projection to the cutting edge. The jaw is thick, coarse, with vertical and parallel transverse lines of reinforcement, but has no appearance of ribs. I have verified this fact by examining numerous specimens of all ages from various parts of the country. My observations have been confirmed by Morse also (Journ. Portland Soc. Nat. Hist. 1864, 7). I am therefore inclined to doubt the identity of the specimen which Heynemann (Mal. Blätt. 1862, Pl. III. Fig. 12) describes with a ribbed jaw. Bergh (Zool. Bot. Gesell. in Wien, XX. 833) suggests that Heynemann may have had *Pallifera dorsalis* before him. Mörch, Journ. de Conch. 1865, suggests that it may have been *Veronicella Floridana*. At all events I do not believe it could have been the species now under consideration. I suspect it to have been *Pallifera Wetherbyi*.

The lingual membrane (Pl. IV. Fig. O) is arranged as usual in the *Helicea*. Morse counted 115 rows of 56—1—56 teeth; another membrane gave 49—1—49 teeth, with 22 perfect laterals; I have myself counted 56—1—56 teeth, with 11 perfect laterals. The central teeth have a very long narrow base of attachment widening towards the lower margin, which is excavated. There is a line of reinforcement running parallel to the lower edge, and for a short distance along the sides. The reflected portion equals only one fourth of the length of the base of attachment. It is stout, and bears a short, stout, median cusp, having a short, blunt cutting point. There are no side cusps or cutting points.

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[1] See descriptions of these singular animals in the new edition of Rafinesque's Complete Conchological Writings. Baillière, New York, 1864. See also Terr. Moll. I, 51, 52.

The laterals are like the centrals, but asymmetrical; their reflected portion is also longer. The outer laterals *b* have an outer side cusp.

The marginals *c* are a simple modification of the laterals, being quadrate, longer than wide, with one inner broad, long, oblique, bluntly pointed cutting point, bearing an inner, side, short, acute cutting point. These cutting points on the extreme marginals *d* are simply short and bluntly rounded.

Some membranes examined by me seemed to have an extension to the base of attachment beyond the upper margin of the reflected portion, to which it was parallel.

This membrane is peculiar in the long, narrow base of attachment and short reflected portion of the central and first lateral teeth.

Tebennophorus Caroliniensis, Bosc.

Vol. III. Pl. LXIII. Figs. 1, 2.

Color of upper surface whitish, or yellowish-white, variegated with clouds and spots of brownish and blackish, so arranged as to form three ill-defined longitudinal bands, one on the centre of the back, and one on each flank, extending from the head to the posterior extremity, anastomosing more or less with each other, and having smaller spots of the same color between them; inferior margin white, or yellowish; foot whitish. Mouth surrounded with a circular row of papillæ. Body elongated, subcylindrical, flattened towards its posterior extremity, which is obtuse; eye-peduncles $\frac{1}{4}$ of an inch long, brownish or blackish, stout, terminating in a bulb; ocular points on the superior part of the bulb; tentacles immediately below the eye-peduncles, white, very short, nearly conical. Mantle fleshy, covering the whole body, its anterior edge tinged with brownish, and falling in a slight curve between the two eye-peduncles, reaching on the sides to the margin of the foot; posterior extremity rounded; cuticle covered with irregular vermiform glands, anastomosing with each other, and having a general tendency to a longitudinal direction, with shallow furrows between, lubricated with a watery mucus, and susceptible of contractions which produce a slow, undulatory motion, like the flowing of water, over the whole surface. Foot whitish, extending a little beyond the mantle posteriorly, showing a whitish flattened border. Orifice of the organs of generation on the right side, at a little distance behind and below the eye-peduncles. Respiratory orifice large, on the right side, $\frac{1}{4}$ of an inch behind the origin of the eye-peduncle; anal orifice in close contact, a little above and in front of it; above the respiratory orifice, on the back, is a deep curved furrow, running upwards and backwards. Locomotive band not distinguished from the lower surface of the foot. Greatest length, when fully extended, 100 mill.; ordinary length, 75 mill.

Limax Caroliniensis, BOSC, Vers de BUFFON de DETERVILLE, 80, Pl. III. Fig. 1. — FÉRUSSAC, Hist., 77, Pl. VI. Fig. 3. — DESHAYES, in LAM., 2d ed., VII. 719 (1836); ed. 3, III. 264 (1839). — MRS. GRAY, Fig. Moll. An.

Limax Carolinianus, DE ROISSY, BUFFON de SONNINI, V. p. 185 (An XIII).

Limax togata, GOULD, Inverteb. Mass. 3 (1841).

Phylomicus Carolinensis, FÉRUSSAC, Tab. Syst. 15. — PFEIFFER, Brit. Mus. Cat., 158. — H. & A. ADAMS, Gen., II. 220. — CHENU, Man. de Conch., I. 469, Fig. 3479 (1859). — KEFERSTEIN (anat.), Zeit. für Wiss. Zool., Bd. XVI. I. 183, Pl. IX. (1866). — BERGH in Zool. Bot. Gesellsch. in Wein. XX. p. 833, anatomy (1870). — HEYNEMANN, Mal. Blätt. 1863, p. 212, t. III. Fig. 12, anat. (?)

Tebennophorus Carolinensis, BINNEY, Bost. Journ. Nat. Hist., IV. 171 (1842); Terr. Moll., II. 20, Pl. LXIII. Figs. 1, 2. — ADAMS, Shells of Vermont, 163 (1842). — DEKAY, N. Y. Moll., 24, Pl. III. Fig. 1 (1843). — WYMAN, Bost. Journ. Nat. Hist., IV. 410, Pl. XXII. (1844), anat. — LEIDY, T. M. U. S., I. 250, Pl. III. (1851), anat. — W. G. BINNEY, Terr. Moll., IV. 3; L. & Fr.-W. Sh., I. 297 (1869). — MORSE, Journ. Portl. Soc., I. 7, Fig. 3; Pl. III. Fig. 4 (1864). — GOULD and BINNEY, Inv. of Mass., ed. 2, 457, Figs. 715, 716 (1870). — TRYON, Am. Journ. Conch., III. 310 (1868).

Limax marmoratus, DEKAY, Cat. N. Y. An., 31, no descr. (1839). — LINSLEY, Shells of Conn., Sill. Journ. [1], XLVIII. 279, no descr.

From Canada to Texas and Florida; a species of the Eastern Province.

In this species the head never projects beyond the mantle. The tentacles and eye-peduncles are contractile and retractile, as in the other slugs. When handled it secretes from the skin a thick, milky, adhesive mucus. Small individuals suspend themselves by a thread. We have noticed its posterior extremity curved upwards when the animal was in motion; at other times flattened and expanded, and again very much corrugated, and apparently truncated; sometimes there *appear* to be one or more mucous glands at this part, and the secretion of mucus from it is more plentiful than from other parts of the body. The mantle is not cleft from the respiratory foramen to the margin, as in most of the slugs, but is provided with a deep furrow or canal running from the orifice to the edge of the mantle below it.

It is very inactive and sluggish in its motions. It inhabits forests, under the bark, and in the interior of the decayed trunks of fallen trees, among which it is particularly partial to the Basswood (*Tilia Americana*).

The variations from the common coloring are numerous. We have already observed the following varieties: —

a. Whitish, without clouded spots, tending to grayish.

b. Whitish, slightly clouded longitudinally.

c. Irregularly clouded with brownish, without any tendency to longitudinal arrangement.

d. With three distinct rows of large clouded spots.

e. With great numbers of fine black spots.

f. Gray, with a line of minute black dots along each side.

g. Blackish-gray, with black lines along each side, and an indistinct line down the middle of the back.

The appearance of the surface of the mantle is constantly changing, from the play of light on its lubricated eye-peduncles, tentacles, and furrows, which are in almost ceaseless motion.

There can be no doubt that this is the animal originally described by Bosc under the name of *Limax Caroliniensis*, though his description is so imperfect that it can only be recognized by the arrangement of colors which belongs to it. His original drawing, engraved in Férussac's work, is a tolerably accurate representation of one of its varieties. He makes no mention of the mantle, and it does not appear in the figure.

An individual of this species kept in confinement deposited about 30 eggs, June 20, 1843; on the 10th of July the young made their way out of the shell. The eggs were semi-transparent, oval, about $\frac{1}{8}$ of an inch in the greatest diameter. The young when excluded were more than a fourth of a inch long, semi-transparent and gelatinous; eye-peduncles and tentacles bluish-black at base, black at tip, the latter very minute and hardly visible. Body broad; back whitish, with two distinct rows of minute black dots down the middle, and other scattering spots on the sides. No perceptible furrow between the mantle and body. They increased very rapidly in size, and in a few days were four times as large as when hatched.

Of the synonymes I have quoted, *Limax togata* is said by Gould (Otia, 182) to be identical; and *Limax marmoratus*, of DeKay, I have ascertained to be the same from the correspondence of my father with Dr. Newcomb.

For jaw and lingual dentition see p. 180.

The genitalia are figured by Leidy, l. c. The testicle lies upon the right side, partly concealed by the liver; it is round and lobulated. The epididymis is tortuous. The vas deferens is very long, tortuous, and muscular. It joins the penis sac at its summit, and has the retractor muscle inserted into it the length of the penis above the latter. The penis sac is irregularly cylindroid, bent at its summit. The ovary is exceedingly lobulated. The oviduct is tortuous, wide, and very much sacculated. The prostate gland is longer than in *Limax* or *Arion*. The generative bladder is large, globular, or nearly so. Its duct is rather less than half the length of the oviduct. At its junction with the neck of the latter an oval muscular organ exists, the dart sac. Within the latter, at the bottom, is a hemispherical papilla, upon the summit of which is placed a white, calcareous, calcarate dart. At the junction of the vagina, common to the neck of the oviduct, duct of the generative bladder, and the dart sac, with the penis, there are two short retractor muscles inserted. The cloaca is narrow and cylindrical, and has surrounding two thirds of its middle a thick glandular organ. Interiorly, the penis sac, cloaca, etc., have a longitudinal rugose surface.

Spurious Species of Tebennophorus, etc.

Tebennophorus bilineatus, Cart., United States, of Grateloup (Dist. Geog. p. 30), is unknown to me.

Philomycus quadrilus, *fuscus*, *oxyrus*, and *flexuolaris* of Rafinesque (see Vol. I. p. 51 and 52), and *Philomycus* (*Eumelus*) *lividus* and *nebulosus* are placed in the same genus as *Tebennophorus Carolinensis* by Gray and Pfeiffer, Brit. Mus. Cat. They are unknown to me.

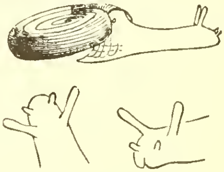
Tebennophorus dorsalis: see *Pallifera*.

HELICODISCUS, Morse.

Animal heliciform: mantle posterior, thin, simple, protected by a shell; other characters as in *Patula*.

Shell discoidal, widely umbilicated, not shining; spire concave; whorls 4, equally visible above and below, the last scarcely larger than the rest, not deflected; aperture rounded, vertical; several pairs of tubercles at intervals within, on the inner surface of the outer whorl; peristome simple, straight, its margins distant.

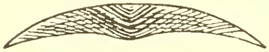
Fig. 90.



Animal of *H lineatus*, enlarged (Morse).

Jaw, according to Morse, of the only known species, *H. lineatus*, low, wide, crescentic, ends much attenuated, acute; cutting margin with a median, beak-like projection; anterior surface without ribs, but covered with striæ converging obliquely towards the beak-like prominence.

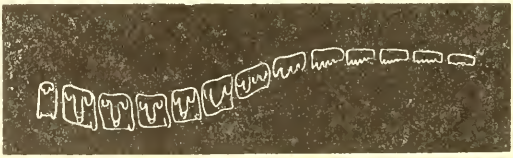
Fig 91.



Jaw of *H. lineatus*.

Fig. 92 shows the general arrangement of the teeth upon the lingual membrane. The characters of the separate teeth are better shown in Plate IV.

Fig. 92.



Lingual dentition of *H. lineatus* (Morse).

Fig. M. Morse gives 77 rows of 12—1—12 teeth, each with 4 perfect laterals. Leidy, in Vol. II. 262, Fig., gives 13—1—13 teeth, with 5 perfect laterals. The membrane examined by me has 12—1—12 teeth, with 4 perfect laterals. The central teeth have a base of attachment very small, longer than wide, with expanded lower angles, and reflected upper margin. Reflection very small, with a stout, short, median cusp, and very short, blunt side cusps, all the cusps with short cutting points. The lateral teeth have a base of attachment three times as wide, and somewhat longer than the centrals, and asymmetrical by the suppression of the inner, lower lateral expansion; the upper margin is broadly reflected; the reflection is short but symmetrical, having two equally developed short, stout side cusps, bearing short cutting points; the median cusp is stout, long, extending nearly to the lower edge of the base of attachment, beyond which projects slightly the short cutting point.

The marginals are low and wide, the reflection as broad as the base of attachment, reaching nearly to its lower edge, and furnished with one inner, long, bluntly bifid, stout, oblique cutting point, and two or more short outer cutting points. The same form of marginal is found in *Pupa.*

The membrane is very peculiar in the lateral teeth, not only from their large size, but also from their symmetrical, tricuspid reflection, quite like the usual arrangement of central teeth in the *Helicea.* Similar lateral teeth are found in *Zonites Gundlachi.*

Helicodiscus lineatus, SAY.

Vol. III. Pl. XLVIII. Fig. 1.

Shell widely umbilicated, discoidal; epidermis greenish; whorls about 4, visible on the base of the shell as well as above, with numerous equidistant, parallel, raised lines revolving upon them; suture much impressed; aperture remote from the axis, semi-lunate, narrow, not expanding; peristome acute, thin; umbilicus wide, forming a concave depression of the base, each volution visible to the apex; within the aperture, on the external circumference, are placed from 1 to 3 pairs of minute, conical, white teeth, the first pair in sight when looking into the aperture, the others more remote. Greater diameter $3\frac{1}{2}$, lesser 3 mill.; height, $1\frac{1}{2}$ mill.

Helix lineata, SAY, Journ. Phila. Acad., I. 18 (1817); II. 273 (1824); Nich. Encycl., 3d ed., IV. (1819); BINNEY'S ed. 7, 24. — BINNEY, Bost. Journ. Nat. Hist., III. 436, Pl. XXII. Fig. 6 (1840); Terr. Moll., II. 261, Pl. XLVIII. Fig. 1. — DEKAY, N. Y. Moll., 44 (1843). — GOULD, Invert., 179, Fig. 103 (1841). — ADAMS, Vermont Mollusca, 161 (1842). — FÉRUSSAC, Tab. Syst., 44; Hist., Pl. LXXIX. Fig. 1. — DESHAYES in FÉR., I. 80. — CHEMNITZ, 2d ed., II. 203, tab. CI. Figs. 13-15. — PFEIFFER, Mon. Hel. Viv., I. 184. — REEVE, Con. Icon., 724 (1852). — W. G. BINNEY, Terr. Moll., IV. 123. — MORSE, Amer. Nat., I. 546, Fig. 44 (1867).

Planorbis parallelus, SAY (?), Proc. Acad. Nat. Sci., II. 164 (1821); ed. BINNEY, 63.

Hyalina ? lineata, W. G. BINNEY, L. & Fr.-W. Sh., I. 52 (1869). — GOULD and BINNEY, Invert. of Mass., ed. 2, p. 404 (1870).

Helicodiscus lineata, MORSE, Journ. Portl. Soc., I. 25, Figs. 61, 62, Pl. II. Fig. 3; Pl. VIII. Fig. 63 (1864). — TRYON, Am. Journ. Conch., II. 264 (1866).

Inhabits all of the Eastern, Central, and Pacific Provinces, having been found from Gaspé to Texas; on the Rio Chama, New Mexico; in Idaho; in Oakland, California.

Jaw: see p. 184.

Lingual membrane: see p. 184.

Animal (see p. 184) nearly white or rather translucent, mottled with small white blotches; body long and narrow; upper posterior portion of foot conspicuously furrowed. In motion the shell lies perfectly flat on the extreme posterior portion of body, the eye-peduncles standing nearly perpendicularly, and the head with tentacles thrust out some way beyond the base of eye-peduncles; eyes scarcely visible; animal very short posteriorly.

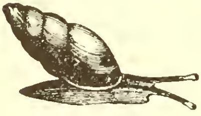
This peculiar shell is distinguished by its discoidal form, greenish color, the fine revolving lines upon its whorls, and the singular teeth which are placed in the interior of the outer whorl. These teeth are arranged in pairs, on the external side of the parietes of the cavity, one of each pair being on the superior and one on the inferior part of the whorl. They are prominent, white, and conical, and may be discovered through the semi-transparent shell. One pair is so near the aperture as easily to be seen, on looking into it; the other is distant nearly one half a volution from the peristome, and is of course invisible except through the shell. At least one pair will be found to exist in every specimen, when carefully sought for; in one instance, I noticed a third pair still further within the whorl.

Noticed under the bark, or in the interstices of wet and decaying wood, and under layers of wet leaves and stones, in damp places, in forests.

FERUSSACIA, Risso.

Animal heliciform, as in *Patula*, obtuse before, pointed behind; mantle subcentral, thin, simple, protected by a shell; anal and respiratory orifices on the right of mantle, under the peristome of the shell; generative orifice behind the right eye-peduncle; no locomotive disk; no caudal mucus pore.

Fig. 93.



Animal of *Ferussacia* (Reeve)

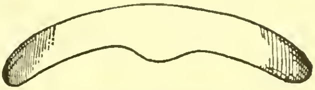
Shell ovate-oblong, imperforate, smooth, pellucid, glistening, dark horn-colored; whorls rather convex; aperture less than one half the shell's length, ovate; columella more or less truncated; peristome blunt, its margins joined by callus.

The genus seems most developed around the Mediterranean Sea, but it is found also in Madeira and Australia. Our only species is circumpolar.

The jaw is low, slightly arcuate, wide, with but slightly attenuated, blunt ends; cutting edge with a slightly produced, wide, median projection; anterior surface without ribs, but with fine vertical striæ. There is a strong muscular attachment on its upper margin. (See Fig. 94.)

Lingual membrane as usual in the *Helicea*. Pl. IV. Fig. R, as well as that of the jaw, I drew from a Maine specimen, furnished by Mr. Anson Allen. There were 24—1—24 teeth, with 8 perfect laterals. The central teeth are small and narrow in proportion to the laterals, with a long, narrow base of attachment, expanding at its lower angles. The reflected portion is very small, tricuspid; the central cusp stout, short; the side cusps small, blunt; all the cusps bear short cutting points.

Fig 94



Jaw of *F. subcylindrica*

The lateral teeth are about as wide as high in their base of attachment, which is subrectangular. The whole upper edge is squarely reflected. The reflection is very short, and bears a stout, blunt, long, inner cusp, reaching almost to the lower edge of the base of attachment, and bearing a long, blunt cutting point, which reaches beyond the lower edge. The outer side cusp of the reflection is widely separated from the inner cusp, is very short, bluntly rounded, and bears a short, blunt cutting point. The first marginals (Fig. *b*) are but a modification of these laterals, by the greater development of the reflection, and shortening of the inner cusp. The outer marginals (Fig. *c*) become wide, low, irregular in shape; the upper edge broadly reflected, the reflection reaching the lower edge of the base of attachment, and bearing along its whole length numerous (6 or 8 in some teeth) short subequal denticles, some bluntly rounded, others longer and sharp, giving a pectinate appearance.

Ferussacia subcylindrica, Linn.

Vol. III. Pl. LII. Fig. 4.

Shell small, thin, transparent, oblong-oval; epidermis smoky horn-color, smooth, very bright and shining; whorls 5 or 6, somewhat rounded, the last equalling two fifths the shell's length, rounded at base; apex obtuse; suture somewhat impressed; aperture lateral, oval, its plane nearly parallel with the axis of the shell; peristome simple, thickened, often slightly rufous; umbilicus imperforate; columella obsoletely truncated at base. Length, 6 mill.; diameter, 2½ mill.; aperture, 2½ mill. long, ½ mill. wide.

Helix subcylindrica, Linn., Syst. ed. XII., II. 1248 (1767). — Not Mont.

Helix lubrica, Müller, Verm. Hist., I. 104 (1774).

Bulimus lubricus, Draparnaud, Moll., 75, Pl. IV. 24. — Gould, Invertebrata, 193, Fig. 124 (1841). — Adams, Shells of Vermont, 157 (1842). — DeKay, N. Y. Moll., 55, Pl. III. Fig. 43 (1843). — Binney, Terr. Moll., II. 283, Pl. LII. Fig. 4.

Achatina lubrica, Pfeiffer, Mon. Hel. Viv., II. 272. — W. G. Binney, Terr. Moll., IV. 138.

Zua lubrica, Leach, Moll., p. 114. — Gray, Man., 188. — Reeve, Brit. L. & Fr.-W. Sh., 93 (1863).

Cionella lubrica, Jeffreys, Linn. Trans., XVI. 327.

Zua subcylindrica, TRYON, Am. Journ. Conch., III. 299 (1868).
Cionella subcylindrica, W. G. BINNEY, L. & Fr.-W. Sh., I. 224 (1869). — GOULD and BINNEY, Inv., 431, Fig. 690 (1870).
Ferussacia lubrica, PFR., Mon., VI. 245 (1868).
Bulimus lubricoides, STIMPSON, Sh. of N. E., 54.
Bulimus subcylindricus, MOQUIN-TANDON, Moll. Fr., II. 304, Pl. XXII. Figs. 15-19.
Zua lubricoidea, MORSE, Journ. Portl. Soc., I. 30, Figs. 79, 81, 84; Pl. X. Fig. 82 (1864); Amer. Nat., I. 607, Fig. 49 (1868).

From Canada to the Red River of the North, and English River; in Nebraska; in New England and the States bordering the great lakes. Thus it belongs to the Northern Region of the Eastern Province. In the Central Province it has been found in Colorado, at Fort Wingate in New Mexico. In the Pacific Province in California and in Alaska. It is a circumpolar species, common to the three continents. In Europe it is found in Spain, Italy, and Illyria, as well as the extreme northern countries. Pfeiffer also quotes it from Madeira.

Animal: head, back, and eye-peduncles blue-black, foot paler, shorter than the shell; tentacles short. (See Fig. 93, p. 180.)

This little species, which is hardly larger than a grain of wheat, is certainly identical with the European shell. It is distributed over a vast expanse of country, and exists in immense numbers in certain favorable localities. Its usual place of abode is under leaves and the bark of decaying trees, in forests and groves. Its surface has a peculiarly brilliant reflection, which excels that of any other of our shells; and hence it has been known in France as "la brillante." There is a slight sinuosity at the union of the peristome with the columella, rendering the aperture a little effuse at this point, and approximating the shell to the genus *Achatina*. This, and its other departures from the typical *Bulimuli*, have caused it, in several instances, to receive a generic distinction. Dr. Leach first indicated it as a separate genus, under the name *Zua*.

My study of the membrane confirms my belief of the identity of the species with the European form (see p. 187). I have carefully compared the dentition of our form with that described and figured by Lehmann (Lebenden Schnecken, 132, Pl. XIII. Fig. 44), and find them to agree. I must, therefore, disagree with the decision of Morse (Journ. Portl. Soc.). I have also examined the genitalia of our species, and found it to agree with Lehmann's figure (l. c.), expecially in the existence of the very peculiar flagellum to the penis sac. This, however, cannot be considered as a most reliable specific character peculiar to this species, as it exists also in *Cæcilianella acicula*.

I am very confident of the presence of well-developed side cusps to the central teeth, which Morse (l. c.) does not figure, though they are figured by Thomson, Ann. Mag. N. H., VII., Pl. IV. Fig. 8. They appear to me also to bear the short cutting points which I have figured.

The genitalia are peculiar: the penis sac is short, stout, with the retractor muscle near its base; the vas deferens enters at its apex, and near its entrance into the vagina it receives a curious flagellate appendage, swollen below, narrow above, as long as the whole system, with a large narrowly ovate bulb at its end; the genital bladder is large, ovate, on a long, narrow duct.

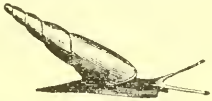
CŒCILIANELLA, Bourg.

Animal as in *Ferussacia* (q. v.), Blind.

Shell elongate, imperforate, polished, vitreous, white, apex rather obtuse; aperture equalling about one half the shell's length, oblong; columella subarcuate, distinctly truncated; peristome simple, acute.

Within our limits it has only been accidentally introduced. It is common among the West Indian Islands, in Europe, South America, etc.

Fig 95.



Animal of *C. acicula.* (Reeve.)

I have not been able to examine the jaw or dentition of *C. acicula*, the only species found in our limits. They are both well known, however, from the descriptions and figures of Moquin-Tandon, Thomson, Sordelli,[1] and Lehmann. The jaw is low, wide, arcuate, with delicate vertical striæ. The lingual membrane (Lehmann, Lebenden Schnecken, p. 128, Pl. XIII. Fig. 43) has 120 rows of 11—1—11 teeth each. The centrals are small, tricuspid (Sordelli), the laterals, 6 in number, are larger, and have a more highly developed reflection, and are also distinctly tricuspid. Marginals subquadrate, with a broad reflection, bearing delicate denticles.

I have examined the jaw and lingual dentition of *C. Gundlachi*, which for the sake of comparison, I repeat here: —

Jaw low, wide, slightly arcuate, ends attenuated; whole surface covered with about 22 crowded, broad, flat ribs, denticulating either margin.

Lingual membrane long and narrow. Teeth 18—1—18, with 4 perfect laterals. Centrals with their base of attachment long, narrow, their reflected portion about one half the length of the base of attachment, tricuspid; the middle cusp stout, with a short blunt cutting point; side cusps subobsolete, but with small distinct cutting points. Lateral teeth with their base of attachment subquadrate, much longer, and very much broader than that of the centrals, the reflected portion short, stout, tricuspid, the middle cusp very stout and long, reaching the lower edge of the base of attachment, beyond which projects the short, stout cutting point; side cusps subobsolete, but bearing distinct, though small cutting points. There are 4 perfect laterals, the fifth tooth being a transition to the marginals, by the base of attachment being lower, wider, not exceeding the reflected portion, with one inner large cusp bearing one outer large cutting point representing the outer cutting point of the first four lateral teeth and one inner, still larger cutting point, representing the middle cutting point of the first four laterals, and one smaller outer cusp, bearing one small, sharp, bifid cutting point, representing the outer side cutting point of the first four laterals. The sixth tooth has the largest cutting point bifid. The balance of the teeth are true marginals. They are very low, wide, with two low wide cusps, bearing each several irregular blunt cutting points.

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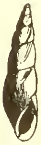
[1] Sordelli (Atti della Soc. Italiana di Sc. Nat., XIII., fasc. 1, p. 50, Pl. 1. Fig. 25) describes the ribs to be not straight, but curving, with a median point projecting toward the end of the jaw, so that each rib resembles quite exactly the sign called "brace" by printers.

The dentition of this species is, as would be anticipated, of the same type as the allied *Cœcilianella acicula* as figured by Lehmann (Lebenden Schnecken Stettins, p. 128, Pl. XIII. Fig. 43, and Sordelli, l. c. Fig. 26). The jaw, however, has no appearance of the "brace" like ribs described in that species by Sordelli (Atti Soc. Ital. Sc. Nat., XIII. 1870, 49, Pl. I. Fig. 25). The ribs are quite like those figured of *Microphysa Lansingi* (p. 172. Fig. 81), although they are narrower.

Cœcilianella acicula, MÜLLER.

Shell cylindrically fusiform, needle-like, attenuated towards the obtuse apex, glassy, polished, white ; suture narrowly margined; whorls 6 to 7, flattened, the last equalling two fifths of the shell's length; columella arcuate, narrowly and abruptly truncated at its base; aperture narrow, lanceolate; peristome simple, straight, acute. Length, $4\frac{2}{3}$ mill.; diameter, $1\frac{1}{4}$ mill.: of aperture, length, 2 mill.; breadth, $\frac{3}{4}$ mill.

Fig 96.



C acicula enlarged.

Buccinum acicula, MÜLLER, Verm. Hist., II. 150 (1774).
Bulimus acicula, BRUGUIÈRE, etc., MOQUIN-TANDON, Moll. Fr., II. 309, Pl. XXII. Figs. 32, 34.
Achatina acicula, LAMARCK, etc., PFEIFFER, Mon. Hel. Viv., II. 274. — REEVE, Brit. L. & Fr.-W. Sh., 97, Fig.
Buccinum terrestre, MONTAGU, etc., etc. For further syn. see PFEIFFER.
Acicula acicula, TRYON, Am. Journ. Conch., III. 300 (1869).
Cionella acicula, W. G. BINNEY, L. & Fr.-W. Sh., I. 227, p. 387 (1869).

The shell figured is from Florida (*Bartlett!* in coll. A. Binney). It agrees well with English specimens, so that I have no doubt of its being the species to which I have referred it. It is not like *A. iota*, of Jamaica, or *A. Gundlachi* of Cuba, or any West Indian species.

Pfeiffer gives Europe and Madeira as the habitat of *A. acicula*. It is said by Moquin-Tandon to live in the crevices of rocks and under moss and dead leaves.

Specimens have lately been found at Princeton, New Jersey, doubtless imported on plants.

Jaw and lingual membrane : see p. 188.

Genitalia as in *Ferussacia subcylindrica*, excepting that the flagellum is shorter, and enters the penis sac at its apex (Lehmann).

STENOGYRA, Shuttl.

Animal: see under *Rumina.*

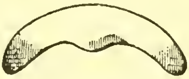
Shell turreted, sometimes truncated, hyaline or white, with a delicate horn-colored, sometimes reddish epidermis; whorls straight, numerous, 7 – 13, gradually enlarging; apex obtuse; aperture semioval or ovate-oblong; peristome straight, generally simple; columella usually truncated.

For further details, see under each subgenus.

I have not been able to examine the jaw or lingual dentition of *S. octonoides* (*S. subula* of L. & Fr.-W. Shells, I.) or *S. gracillima*, but only *S. decollata*, Lin., from Charleston, South Carolina, a species introduced from Europe by commerce, and the true *S. subula* found near Mobile, Alabama. Of extra-limital species I have examined *S. octona*, *gonostoma*, and *hasta*. Semper has examined *S. Panayensis.*

The jaw (see Fig. 97 for that of *S. subula*) is low, wide, with attenuated, blunt ends, and a wide, slightly produced median projection. There are distinct vertical striæ on that of *S. decollata*.

Fig. 97.



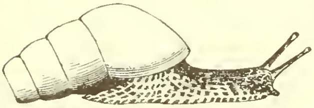
Jaw of *S. subula.*

The lingual membrane is long and narrow. The central tooth has a very small, high, narrow base of attachment, the lower outer angles generally somewhat expanded. The reflected portion is very small, and bears a short, stout, median cusp, and two very small side cusps; all the cusps bear distinct cutting points. The lateral teeth are very much larger than the centrals. The base of attachment is about as high as wide, its inner lower lateral expansion suppressed as usual. The upper edge is squarely reflected. The reflection is very large, and bears one stout median cusp, extending almost to the lower edge of the base of attachment; there is also an outer, much smaller side cusp, and a less developed, sometimes subobsolete inner side cusp; all the cusps have distinct cutting points, proportioned to their size; that on the central cusp being greatly developed. In *S. decollata* (Pl. IV. Fig. Q) the inner cutting point is also much developed, and joined to the central cutting point. The marginal teeth in *S. decollata* (*b*) are but a modification of the laterals, with the suppression of the inner cusp and cutting point; the extreme marginals (*c*) differ in the greater development of the reflected portion and equalization with it of the cutting points, of which there are but two. In *S. subula* (Pl. IV. Fig. P) the marginal teeth (*b*) have more numerous cutting points, formed by the bifurcation of the inner and outer cutting point. The second denticle from the inner side is the largest. It will be noticed that in *S. decollata* both the side cutting points of the laterals are quite thorn-shaped.

Subgenus RUMINA, Risso.

Animal heliciform, blunt before, pointed behind; mantle posterior, thin, protected by a shell; respiratory and anal orifices on the right of the mantle under the peristome of the shell; generative orifice behind the right eye-peduncle; no locomotive disk; no caudal mucus pore.

Fig. 98.



Animal of *Stenogyra decollata.*

Shell obsoletely rimate, calcareous, normally truncated, cylindrically elongate; remaining whorls 4–6, the upper truncated ones 8–10, the upper one globular; aperture semioval; peristome straight, thickened within, its margins connected with callus, the columellar twice as short as the external one; columella not truncated.

Jaw and lingual membrane: see p. 191.

A single species is known, which inhabits Europe. It has been introduced by commerce into Charleston, South Carolina.

Stenogyra decollata, LINN.

Vol. III. Pl. I. Fig. 1.

Shell rather thick, long, cylindrical, turreted; epidermis shining, whitish, with a slight tint of brownish or yellowish; apex obtuse; spire gradually enlarging from the apex to the aperture, commonly abruptly truncated between the third and fifth whorls next the aperture; whorls remaining 3 to 5, flat, a little wrinkled, and in the last two or three slightly crenate, or plaited below the suture; suture not impressed; aperture lateral, oval, angulated superiorly, its plane very nearly parallel with the axis of the shell; peristome simple, thickened within, its columellar portion reflected. Axis of the truncated shell usually about 25 mill.; diameter of the largest whorl less than 12 mill.

Helix decollata, LINNÆUS, Syst. Nat. 1247, etc.

Bulimus decollatus, DRAPARNAUD, 76, Pl. IV. Fig. 27, etc. — PFEIFFER, Mon. Hel. Viv., IV. 456. — BINNEY, Terr. Moll., II. 280, Pl. I. Fig. 1. — W. G. BINNEY, Terr. Moll., IV. 131. — LEIDY, T. M. U. S., I. 259, Pl. XV. Figs. 5, 6 (1851), anat.

Bulimus multilatus, SAY, Journ. Acad. Nat. Sci. Philad., II. 373; ed. BINNEY, 25 (err. typ. for *mutilatus*).

Bulimus mutilatus, DEKAY, N. Y. Moll., 56 (1843). — PFEIFFER, Mon. Hel. Viv., II. 153; III. 397. — REEVE, Con. Icon., Fig. 331.

Rumina decollata, TRYON, Am. Journ. Conch., III. 300 (1868).

Stenogyra decollata, W. G. BINNEY, L. & Fr.-W. Sh., I. 228 (1869).

An European species, introduced at Charleston, South Carolina, where it has increased very rapidly, and has retained its position for more than fifty years. It has also been introduced in Cuba and Brazil.

Animal (see Fig. 98): body short, extending but little behind the aperture, blackish or bluish-black on the head and back, with decidedly green reflections in certain lights, the sides and posterior extremity olivaceous; surface finely granulated; eye-peduncles slender and rather short; ocular points very small; tentacles very short. The shell is carried nearly horizontally when in motion.

It is very voracious in its habits. I kept a number of individuals received from Charleston a long time as scavengers, to clean the shells of other snails. As soon as a living *Helix* was placed in the box with them, one would attack it, introduce itself into the inner whorls, and completely remove the animal. Leaving a number of *Succinea ovalis*, Gld., with them one day, the former disappeared entirely in a short time. The *Stenogyra* had eaten shell as well as animal.[1]

The young shell is thin, transparent, and fragile; the old is opaque and rather thick. It is very peculiar in respect to the manner of breaking off and abandoning successive portions of the spire. According to the plan upon which the shell is projected, it would, when it reaches the full size which it attains in this country, possess ten or more full volutions, if it retained all of them from the apex downward. But as fast as the growth of the animal compels it to increase the number and volume of the whorls, it releases its connection with the superior whorls, creates a new attachment lower down, forms a new apex or spiral calcareous septum, which separates it from the abandoned part, and, in some manner which is not understood, breaks and throws off those whorls which are no longer of use.[2] This commences at a very early period; the original apex being thrown off when the shell has acquired 5 or 6 whorls. They differ in this particular from most of land shells, and especially from the *Helices*, which always, so far as I know, retain their original attachment to the apex of the shell. It has been thought that the breaking of the spire, after being left by the animal, and becoming dry and brittle, is accidental; but I conceive that the effect is much too constant to be accounted for in that way. I have never been able to find a mature specimen with the apex. And in all the various countries which it inhabits, including the whole southern part of Europe, the northern part of Africa, the islands of the Mediterranean, the Canaries, Madeira, etc., the same peculiarity attends it. If it were only an accident, some few in this wide extent might escape. I doubt not, therefore, that it is effected by the action of the animal itself. It may be that the calcareous matter of the shell is absorbed at the point of division, previous to the formation of the new septum.

Mr. Say made out his description from an immature specimen.

The epiphragm is white, pearly, and opaque; it fills up the aperture, and when pushed out by the animal, generally falls entire. It may be seen in numbers about their winter-quarters. Its outline is represented in Vol. III. Pl. 1.

Jaw and lingual membrane: see p. 191.

Lingual membrane (Pl. IV. Fig. Q, *b* is one of the first marginals, *c* extreme marginal), — a Charleston specimen. There are 38—1—38 teeth, with 11 perfect laterals.

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[1] I find no notice of any such carnivorous habits mentioned by Moquin-Tandon. It may be the species prefers vegetable food, but being deprived of that was forced by hunger to devour animal food.

[2] Moquin-Tandon says (on the authority of Gassies) that the animal breaks off the upper whorls by jerking round its shell against some hard object.

The genitalia are figured by Leidy (Vol. I. Pl. XV. Figs. 5, 6). The genital bladder (6) is small, globular, with a short, narrow duct entering the vagina near its upper end: the penis sac (3) is short, stout, cylindrical, with a median constriction; it receives the vas deferens and retractor muscle at its apex.

Subgenus OPEAS, Albers.

Animal not observed.

Shell minutely perforated or rimate, thin, striated, slightly or moderately smooth; whorls 6 – 8, rather convex, the last usually compressed; aperture ovate-oblong, equalling one third to one fourth of the shell's length; peristome simple, acute, its columellar margin reflected. Size moderate or small.

East Indies, West Indies, Africa, South America. In our country it has only been introduced into the Southern Region.

Jaw and lingual dentition: see above, p. 191.

Stenogyra octonoides, D'Orbigny.

Vol. III. Pl. LIII. Fig. 4.

Shell small, elongated, turreted, transparent, with delicate, longitudinal striæ, sometimes of a spermaceti white, and sometimes wax-yellow; whorls about 8, convexly rounded, revolving more closely at apex than elsewhere, so as to form a somewhat obtuse summit, the last whorl less than one third the length of the shell; suture deeply impressed; columella nearly straight; aperture elongated, narrow, rhomboid-elliptical; peristome simple, its right margin straight, its columellar margin slightly reflexed, protecting a minute umbilical perforation. Length of axis, 13 mill.; diameter, about 3 mill.

Bulimus octonoides, D'Orb., Moll. Cub., I. 177, tab. XI. Figs. 23, 24; Pl. XI. bis, Figs. 22 – 24. — Pfeiffer.

Bulimus subula, Binney, Terr. Moll., II. 285, Pl. LIII. Fig. 4. — W. G. Binney, Terr. Moll., IV. 134. — Not of Adams.

Found in the Florida Subregion, at Fort Dallas, Florida, and in several of the West India Islands, Cuba, St. Thomas, Jamaica, Porto Rico. It has also been found in Charleston, South Carolina.

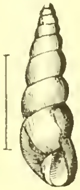
This species belongs to a somewhat numerous group found in the tropics, wherever the banana and other *Musaceæ* flourish; some of which have the columella truncated, and were formerly arranged under the genus *Achatina*, like *S. octona*, though by their natural affinities they are clearly associated. The banana and plantain have, by transplantation, become naturalized throughout the tropics; and it is highly probable that many shells found with them, which have received different names merely because they have been found in localities far remote from each other, are really identical. This shell is considerably smaller and more rapidly tapering than *S. octona*, which has its columella somewhat truncated, and has not as yet been found on this continent.

This, according to Mr. Bland, is not the true *S. subula* (q. v).

Stenogyra subula, Pfr.

Shell subperforate, subulately turreted, delicately striated, shining, transparent waxen; whorls 8, rather convex, the last about equalling two sevenths of the length; columella straight; aperture oval-oblong; peristome simple, acute, its right extremity straight, its columellar extremity very slightly reflected, appressed. Length, 11½ mill.; width, 3 mill.: of aperture, length, 3 mill.; width, 3⅓ mill. (Pfeiffer.)

Fig. 99.



Stenogyra subula.

Stenogyra subula, Pfeiffer, Mon., II. 158, not of Binney, etc.

A West Indian species introduced into the Southern Region at Mobile.

For jaw and dentition see ante, p. 191, Fig. 97. (Pl. IV. Fig. P., *b* is an extreme marginal.) There are 24—1—24 teeth, with 6 perfect laterals.

There were eggs in the oviduct of the Mobile individuals examined by me.

It must be borne in mind that this is not the shell described and figured under this name in Vol. II., and Land and Fresh-Water Shells, I., which is *S. octonoides*, D'Orb. (See above.)

Subgenus MELANIELLA, Pfr.

Animal not observed.

Shell imperforate, ribbed, usually decussated, sculptured, brownish horn-colored, rather solid; whorls 9, rather convex, graduated, the three or four upper ones without ribs; aperture effuse at base, ovate; columella constricted; peristome simple, subcontinuous.

A West Indian subgenus. One species has been introduced into the Florida Subregion.

Stenogyra gracillima, Pfr.

Vol. III. Pl. LIII. Fig. 3.

Shell imperforate, minute, elongated, very slender, thin, of a drab-white color, ornamented with elevated, compressed, sharp, rather distant, longitudinal ribs, of which there are from 20 to 30 on each whorl, the interstices sculptured by very crowded lines; spire obtuse at the apex, and composed of about 8 flattish whorls, the last of which is about one fourth the length of the shell, and somewhat angular below the middle; suture deeply impressed; aperture small, elongated, rhomboidal-ovate; peristome sharp, and somewhat pressed inward, so as to be parallel to the axis; the columella is straight, and joins the peristome at an angle, so as almost to form a notch at the base of the aperture. Length, 7 mill.; diameter, 1¾ mill.; aperture, 2 mill. long, 1 wide.

Achatina gracillima, PFEIFFER in WIEGM. Arch., 1839, I. 352. — BINNEY, Terr. Moll., II. 293, Pl. LIII. Fig. 3.

Bulimus gracillimus, PFEIFFER, Symb., III. 54; Mon. Hel. Viv., II. 160. — REEVE, Con. Icon., 594. — W. G. BINNEY, Terr. Moll., IV. 134.

Achatina striato-costata, D'ORBIGNY, Moll. Cub., I. 176, Pl. XI. Figs. 19–21?

Melaniella gracillima, TRYON, Am. Journ. Conch., III. p. 301 (1868).

Stenogyra gracillima, W. G. BINN., L. & Fr.-W. Sh., I. 232 (1869).

Cuba, St. Thomas; also Bahamas; introduced into the Florida Subregion, having been found on the Keys, and on the mainland near the Miami River.

Animal not observed.

EXTRALIMITAL SPECIES OF STENOGYRA.

Stenogyra (Subulina) octona, CHEMNITZ, has been found in greenhouses, having been introduced on plants.

PUPA, DR.

Animal heliciform (Vol. III. Pl. LXXII. Fig. 1), blunt before, tapering behind; mantle posterior, thin, protected by a shell; respiratory and anal orifices on the right side of the mantle, under the peristome of the shell; generative orifice behind the right eye-peduncle; no caudal mucus pore or locomotive disk.

Shell cylindrical, ovate or buliform, rimate or perforate; last whorl proportionally small; aperture semioval or subrotund, generally furnished with entering, fold-like denticles; peristome expanded or subsimple, margins equal, subparallel, distant, usually connected with a callous lamina.

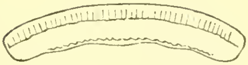
The genus is widely distributed.

Most of the species are so small that it requires much care and no little skill to find them. Some are found in forests, under decaying leaves or fragments of dead branches, lying on the ground, or in the crevices of bark, or about decaying stumps and logs; some are found in plats of moss, others under stones, sticks, etc., in the open fields; and many at the margins of brooks, pools, and ponds, under chips, or crawling up the stems of plants, and seem to be incapable of existing unless abundantly supplied with moisture, seeming to be aquatic rather than terrestrial in their habits. They feed on decaying vegetable matter, keeping themselves in the shade, and adhering closely to the objects on which they rest when in repose. In the winter they bury themselves under the leaves or in the earth.

Animal small, about twice as long as broad, wide and square in front, slightly tapering and obtusely rounded posteriorly; beneath, the head is separated from the foot by a transverse line; the cephalic portion is transverse, more or less lobed in front; the base of foot is long-oval, truncate in front. Tentacles short and sometimes reduced to a minute tubercle. The viscera are remarkable for their great length

I have personally examined the jaw and lingual membrane in only two species, *P. fallax* (Pl. IV. Fig. T) and *P. rupicola* (Pl. IV. Fig. S). For information about the other species I am indebted to Mr. Morse, whose figures are copied below.

Fig. 100.



Jaw of *Pupa badia* (Morse).

The jaw is low, wide, arcuate (in *P. rupicola*, strongly arched); ends but little attenuated in *muscorum*, *pentodon*, *fallax*, *rupicola*, acutely pointed in *corticaria*; a more or less developed, broad, blunt median projection to the cutting edge; anterior surface without ribs, but generally with vertical striæ.

Pl. IV. Figs. S and T show more correctly the characters of the individual teeth of the genus, the general arrangement being as in *Patula*. The membrane is long and narrow, the teeth are as in the genus *Vertigo* described below; excepting that in *Pupa* the central tooth is quite small in proportion to the laterals. The marginal teeth are irregularly denticulated, the inner denticle the largest.

SUBGENUS PUPILLA, LEACH.

Animal, as in the genus, small, short; tail short, pointed; eye-peduncles long; tentacles stout, very short.

Shell deeply rimate or perforate, cylindrically shortened, apex extended into an obtuse cone; horn-colored, smooth; whorls 5–9; aperture rounded with few or no folds; peristome somewhat expanded.

Pupa muscorum, LIN.

Vol. III. Pl. LXX. Fig. 3.

Shell perforate, cylindrical, subfusiform, obtuse at both extremities; epidermis dark chestnut-color or bay; whorls 6 to 7, rounded, the anterior 4 of about equal diameter; suture deep; aperture lateral, nearly circular, small, its diameter equal to two thirds of the diameter of the last whorl, a thin, testaceous deposit forming a thickened margin internally, sometimes bearing an obtuse tubercle; upon the parietal wall is a single tubercle; transverse margin subreflected; peristome slightly reflected. Length, 4 mill.; breadth, 1½ mill.

Pupa badia, ADAMS, Bost. Journ. Nat. Hist., III. 331, Pl. III. Fig. 18; Shells of Vermont, 157. — GOULD, Bost. Journ. Nat. Hist., III. 404; IV. 360. — DEKAY, N. Y. Moll., 49, Pl. IV. Fig. 45. — CHEMNITZ, ed. 2, 117, Pl. XV. Figs. 25–29. — BINNEY, Terr. Moll., 323, Pl. LXX. Fig. 3. — W. G. BINNEY, Terr. Moll., IV. 142.

Pupa muscorum, LINNÆUS, part, PFEIFFER, Mon. Hel. Viv., IV. 666, etc. — W. G. BINN., L. & Fr.-W. Sh., I. 234 (1869). — GOULD and BINN., Invert of Mass., ed. 2, 433 (1870).

Pupilla badia, MORSE, Journ. Portl. Soc., I. 37, Figs. 89, 91, Pl. X. Fig. 92 (1864); Amer. Nat., I. 609, Fig. 52 (1868). — TRYON, Am. Journ. Conch., III. 302 (1868).

A circumpolar species, in our limits found in the Northern Region, on the islands in the Gulf of St. Lawrence, and in Maine, Vermont, and New York;

in the Central Province, in Nevada and Colorado. Its range in Europe is very great, being found from Siberia to Sicily, England, Iceland, etc.

The shell is often met with an edentulate aperture. Such is the specimen figured in the second edition of Chemnitz.

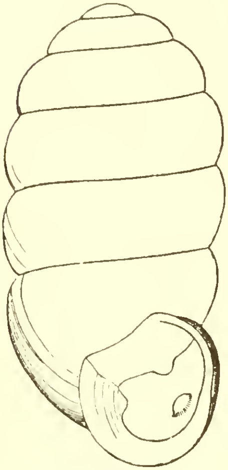
Jaw of American specimen slightly arched, concave edge waving; anterior surface striate. (See Fig. 100.)

P. muscorum has 90 rows of 14—1—14 teeth, with 6 perfect laterals on its lingual membrane. (See Morse.) The figure and description of Lehmann of the European *P. muscorum* confirm my belief in the identity of the two forms.

Pupa blandi, MORSE.

Shell rimate, ovate-cylindrical, delicately striated, opaque, light brown; apex obtuse, nucleus with microscopic granulations; suture well defined; whorls 6, subconvex, the last ascending at the aperture, rapidly expanding, with an external whitish callus, between which and the peristome there is a deep constriction; aperture small, nearly circular, with 3 obtuse teeth of about equal size, one on the parietal margin, one on the columellar margin, and the third far within and at the base of aperture; peristome subreflected, the margins joined by a thin callus. Length, .13 inch, breadth, .06 inch. (Morse.)

Fig. 101.



Pupa Blandi, enlarged.

Pupilla Blandi, MORSE, Ann. N. Y. Lyc., VIII. 211, Fig. 8 (Nov., 1865). — TRYON, Am. Journ. Conch. III. 303 (1868).

Pupa Blandi, W. G. BINNEY, Expl. in Nebraska, Ex. Doc. 25th Congress, 2d Sess., II. part 2, p. 725 (1859), no descr.; L. & Fr.-W. Sh., I. 235, Fig. 402 (1869).

In drift on Missouri River, near Fort Berthold, and in Dakota and Colorado. It is evidently a species of the Northern Region, but extending into the Central Province on the mountain-ranges.

Animal unknown.

Pupa Hoppii, MÖLLER.

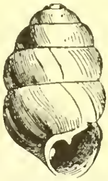
Shell subperforate, cylindrically ovate, thin, very delicately striated, horn-colored, shining, pellucid; spire terminating in an obtuse cone; whorls 5, rather convex, the last scarcely equalling two fifths the shell's length, ascending above, somewhat narrowed towards the base; columella deeply subplicate, parietal wall of the aperture furnished with one tooth-like callus; aperture vertical, subsemicircular; peristome thin, scarcely expanded, its right termination quite arched. Length, $2\frac{3}{4}$ mill.; diameter, 1 mill.

Pupa Hoppii, Möller, Ind. Moll. Gr., 4 (1842). — Troschel, Arch. f. Nat., 1843, II. 126. — Chemnitz, ed. 2, 163, Pl. XIX. Figs. 29, 30. — Pfeiffer, Mon. Hel. Viv., II. 328; III. 536; IV. 666. — W. G. Binney, Terr. Moll., IV. 147. — Mörch, Amer. Journ. Conch., IV. 30, Pl. III. Figs. 6-9 (1868). — W. G. Binney, L. & Fr.-W. Sh., I. 235 (1869).

Pupa Steenbuchii, Beck, teste Mörch, Nat. Bidrag af Gr. 75.

Pupilla Hoppii, Tryon, Amer. Journ. Conch., III. Pl. 4, p. 303.

Fig. 102.



Pupa Hoppii, enlarged.

Inhabits Greenland, and has also been found at Anticosti Island. It is therefore a species of the Northern Region.

The description given above is translated from Pfeiffer. The specimen figured, which I refer to this species, has another denticle on the columella, and a lamina-like process within the aperture at the base of the last whorl.

Full information on the species is given by Mörch, l. c. He describes the animal as grayish, foot bluish-gray; head, eye-peduncles, and mantle margin black; eye-peduncles rather long; tentacles none or nearly none; the foot a little shorter than the shell. He refers also to an albino variety, destitute of epidermis.

Jaw, dentition, and genitalia unknown.

Pupa variolosa, Gould.

Vol. III. Pl. LXXII. Fig. 3.

Shell minute, ovate-conical, with a pointed apex, of a yellowish-green color, apparently smooth, but when examined by a considerable magnifying power, is found to be thickly pitted with dots of unequal size and irregularly disposed; there are 4 or 5 narrow, tumid whorls, separated by a profound suture; the aperture is obliquely semi-oval, and has a posterior lamellar tooth winding within the shell, a tooth on the columella, and another a little to the right of the basal apex; a small umbilical opening is covered by the reflected columellar margin of the peristome, and the other margin is slightly everted. Length, 2 mill.; diameter, 1 mill.

Pupa variolosa, Gould, Proc. Bost. Soc. Nat. Hist., III. 40; Terr. Moll., II, 331, Pl. LXXII. Fig. 3. — Pfeiffer, Mon. Hel. Viv., III. 556. — W. G. Binney, Terr. Moll., IV. 146; L. & Fr.-W. Sh., I. 236 (1869). — Tryon, Amer. Journ. Conch., III. 303 (1868).

Florida Subregion, on the extremity of the peninsula.

This species is our smallest, and is most readily distinguished by its short, conical form. The five specimens examined all presented the crowded, thimble-like impressions, under a magnifying power of twenty diameters. It is the only American species which has a tooth revolving within the shell, on the penultimate whorl.

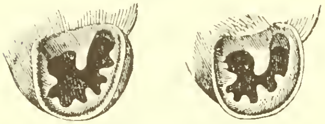
Animal unobserved.

Pupa pentodon, Say.

Vol. III. Pl. LXXII. Fig. 1.

Shell subperforate, of an elongated ovate form, minutely striated, and of a spermaceti or whitish horn-color; whorls about 5, well rounded, and separated by a deep suture; apex rather acute; aperture oblique, nearly semicircular; peristome sharp, and somewhat expanded, but not reflexed; the submargin of the throat is thickened by a ridge of white callus, on which the denticles are situated; one of these, and sometimes two, is on the parietal wall, two on the columellar portion of the peristome, and two constantly, and from one to five others occasionally, on the other portion of the peristome; of these, that near the middle of the parietal wall is largest, that at the upper part of the columella is next, and one opposite the first, on base of the aperture, is the third in size. Length, 2 mill.; diameter, 1 mill.; of aperture, length, $\frac{2}{3}$ mill.

Fig. 103.



Pupa pentodon.

Vertigo pentodon, Say, Journ. Acad. Nat. Sci. Phila., II. 476 (1822); ed. Binney, 27.

Pupa pentodon, Gould, Bost. Journ. Nat. Hist., IV. 353, Pl. XVI. Figs. 10, 11 (1843). — DeKay, N. Y. Moll., 50, Pl. IV. Fig. 48; Pl. XXXV. Fig. 337 (1843). — Pfeiffer, Mon. Hel. Viv., II. 359; in Chemnitz, ed. 2, 125, Pl. XVI. Figs. 24-26. — Binney, Terr. Moll., II. 328, Pl. LXXII. Fig. 1. — W. G. Binney, Terr. Moll., IV. 143; L. & Fr.-W. Sh., I. 238 (1869). — Gould and Binney, Inv. of Mass., ed. 2, 404 (1870).

Pupa curvidens, Gould, Invertebrata, 189, Fig. 120 (1841).

Pupa Tappaniana, Adams, Silliman's Journ., [I] XL. Suppl.; Shells of Vermont, 158 (1842). — Pfeiffer, Symbolæ, II. 55.

Leucochila pentodon, Morse, Journ. Portl. Soc., I. 36, Fig. 85; Pl. X. Fig. 86 (1864); Amer. Nat., 667, Fig. 56 (1868).

Pupilla pentodon, Tryon, Am. Journ. Conch., III. 303 (1868).

Northern and Interior Regions, having been found from Georgia and Mississippi to the most northern portions of the Union. It is usually found at the foot of trees and under leaves.

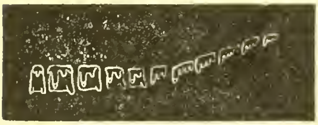
Animal blackish above, light gray below; foot moderately long, the transverse fissure very distinct, the anterior portion having the mouth in the centre, and bilobate in front. Tentacles about one third as long as the eye-peduncles. Very sluggish in its movements, and carries the shell nearly horizontally, or very slightly elevated.

Jaw slightly arcuate, of uniform breadth, anterior surface longitudinally striate, concave margin minutely notched.

Lingual membrane with 64 rows of 21 (10—1—10) teeth; centrals with three subequal, very small cusps; laterals bicuspid, marginals serrate, the inner point much developed.

This is a very variable species. The ordinary specimens vary chiefly in the armature of the aperture, the marginal, internal rim of calcareous matter thickening with age, and developing more numerous denticles. The Ohio specimens are of more than ordinary size, clean and shining, and were the form designated by Professor Adams as *P. Tappaniana.* Those found in Massachusetts are considerably smaller covered with a well-developed epidermis, and often, if not always, have the aperture decidedly modified in form, being more triangular, and the denticles more or less curved. To these was applied the name *curvidens;* and the modifications are so constant as to incline us still to regard them as constituting a distinct species. With all its variations, it has an aspect which enables us readily to separate it from all other species. The form of the shell itself, and its semicircular aperture, are sufficiently peculiar. A more careful examination of the animal shows decidedly that it does not belong to *Vertigo*, as supposed by Mr. Say.

Fig. 104.



Lingual dentition of *Pupa pentodon.*

Pupa decora, Gould.

Vol. III. Pl. LXXI. Fig. 3.

Shell minute, cylindrical, rounded at apex, thin, shining, translucent, of a wine-yellow color, regularly striated by lines of growth; spire of 5 or 6 closely revolving, rounded whorls, deeply separated at the sutures; aperture nearly round or semi-oval, obliquely limited by the penultimate whorl, armed with 4 slender denticles, the largest of them on the parietal wall, 1 on the columellar portion of the peristome, and 2 on the outer portion, all disposed so as to form the arms of a cross; the peristome is slightly reflexed, and indented opposite the base of the two labial denticles; at the columella it rises against a distinct umbilical perforation. Length, 2½ mill.; diameter, 1½ mill.

Pupa decora, Gould, Proc. Bost. Soc. Nat. Hist., II. 263 (Dec., 1847), with a woodcut; in Terr. Moll., II. 327, Pl. LXXI. Fig. 3. — Pfeiffer, Mon. Hel. Viv., III. 555. — W. G. Binney, Terr. Moll., IV. 143; L. & Fr.-W. Sh., I. 238 (1868). — Gould and Binney, Inv. of Mass., ed. 2, 435 (1870).

Pupilla decora, Tryon, Am. Journ. Conch., III. 304 (1868).

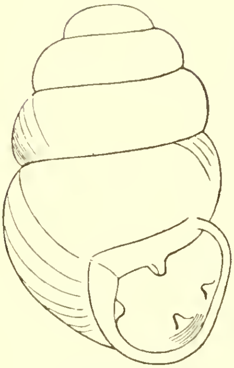
Near Lake Superior. Fort Resolution, Great Slave Lake. It thus appears to be a species of the Northern Region.

Animal unobserved.

Pupa corpulenta, Morse.

Shell rimate perforate, elongate ovate, finely striated, polished, translucent, dark olive-brown; apex round, obtuse; whorls 4, convex, tumid, wider at the

Fig. 105.



Pupa corpulenta, enlarged.

base; aperture large, subcircular, with 4 obtuse teeth, 1 on the parietal margin, 1 on the columellar margin, and 2 on the labrum; peristome slightly thickened and reflected. Length, .10 inch; breadth, .06 inch. (Morse.)

Isthmia corpulenta, MORSE, Ann. N. Y. Lyc., VIII. 210, Fig. 7 (Nov. 1865).
Pupa corpulenta, W. G. BINNEY, L. & Fr.-W. Sh., I. 238 (1869).
Pupilla corpulenta, TRYON, Am. Journ. Conch., III. 309 (1868).

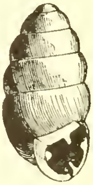
Little Valley, Washoe Co., Nevada; on east slope of Sierra Nevada, 6,500 feet above the sea; Colorado; thus far not noticed outside the Central Province.

Animal unobserved.

Pupa Rowelli, NEWCOMB.

Shell perforate, oblong-ovate, dark horn-colored, shining, translucent, finely striated; apex obtuse; whorls 5, convex; aperture truncately ovate, armed with 4 teeth, 1 prominent and plicate on the columella, 3 deeply seated within the aperture, 1 on the columella, 2 within the peristome; peristome slightly reflected. Length, 2 mill.; breadth, 1 mill.

Fig. 106.



Pupa Rowelli, enlarged.

Pupa Rowellii, NEWCOMB, Ann. N. Y. Lyc., VII. 146. — BLAND, Ann. N. Y. Lyc., VIII. 166, Fig. 11 (1865). — W. G. BINNEY, L. & Fr.-W. Sh., I. 238, Fig. 412 (1869).
Pupilla Rowellii, TRYON, Amer. Journ. Conch., III. 304 (1868).

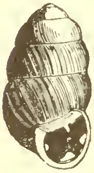
A species of the California Region; California, near Oakland, Monterey, San Bernardino, El Dorado County.

Animal unobserved.

Pupa Californica, ROWELL.

Shell rimately subperforate, elongate-ovate, thin, dark horn-colored; with oblique rib-like striæ; apex obtuse; deep suture; with 5 to 6 convex whorls, the last a little compressed at the aperture; aperture oblique, suborbicular, armed with 4 white denticles; one lamelliform, strongly developed, slightly twisted, on the parietal wall, one on the columella, and two deeply seated within or near the base of the aperture; peristome slightly expanded, columellar margin somewhat reflected. Longitude, 2½ mill.; diameter, 1 mill.

Fig. 107.



Pupa Californica, enlarged.

Pupa Californica, NEWCOMB, Ann. N. Y. Lyc., VII. 287. — BLAND, Ann. N. Y. Lyc., VIII. 166, Fig. 12 (1865). — W. G. BINNEY, L. & Fr.-W. Sh., I. 239, Fig. 413 (1869).

Pupilla Californica, TRYON, Amer. Journ. Conch., III. 304 (1868).

San Francisco, California, and at Catalina Island, in the California Region. It is also quoted from Colorado by Ingersoll, but I am not sure of the identity of his specimens.

Animal unobserved.

SUBGENUS LEUCOCHILA, ALB. & MART.

Animal as in *Pupilla*.

Shell rimate, cylindrically ovate, apex rather obtuse; rather smooth, shining, pellucid; whorls 6 – 7, rather convex, aperture semi-oval, edentulate or narrowed by folds, among which the parietal is the strongest; peristome thickened, reflected, its external margin decidedly arcuate.

Pupa fallax, SAY.

Vol. III. Pl. LII. Fig. 1.

Shell fusiform, regularly diminishing in volume from the body-whorl to the apex, smooth; epidermis brownish horn-color; whorls 6, very convex, striæ of growth hardly apparent; suture well impressed; aperture lateral, rounded oval; peristome white, rather broadly reflected, lined within with white callus, its right termination strongly curved; umbilicus perforated. Length, 5½, diameter, 2 – 2½ mill.; aperture, 1⅝ mill. long.

Cyclostoma marginata, SAY, Journ. Acad. Nat. Sci. Phila., II. 172 (1821); BINNEY'S ed., 22.

Bulimus marginatus, PFEIFFER, Mal. Blätt., II. 94; Mon. Hel. Viv., IV. 414. — W. G. BINNEY, Terr. Moll., IV. 136.

Bulimus fallax, GOULD, in Terr. Moll., II. 288, Pl. LII. Fig. 1.

Pupa fallax, SAY, Journ. Acad. Nat. Sci. Philad., V. 121 (1825); BINNEY'S ed., 28. — GOULD, Invertebrata, 192, Fig. 123 (1841), excl. syn. *placida*; Bost. Journ. Nat. Hist., IV. 357, Pl. XVI. Fig. 15 (1843). — DEKAY, N. Y. Moll., 51, Pl. XXXV. Fig. 331 (1843). — PFEIFFER, Mon. Hel. Viv., II 309; III. 333; in CHEMNITZ, ed. 2, 58, Pl. XII. Figs. 20, 21 (1844). — W. G. BINNEY, L. & Fr.-W. Sh., I. 239 (1869).

Leucochila marginata, TRYON, Am. Journ. Conch., III. 305 (1868).

Leucochila fallax, TRYON, l. c.

Pupa Parraiana, D'ORBIGNY, Moll. Cuba, 181, Pl. XII. Figs. 9 – 11 (1853).

Pupa albilabris, ADAMS, Vermont Mollusca, p. 158 (1842); Silliman's Journ. [I], XL. 271.

Pupilla fallax, MORSE, Amer. Nat., 609, Fig. 53 (1868).

Paludina turrita, MENKE? Syn. Méth., 40.

From Nebraska to Texas and from New England to South Carolina. It may therefore be considered to range over all of the Eastern Province.[1] In several of the West India Islands, also.

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[1] Referred to *cœnopictus* and *pacifica* by Jickeli, Verh. L. C. Akad., XXXIII., 97, Pl. V. Fig. 1, radula, II. 1.

Head, neck, and eye-peduncles black, posterior and lower parts lighter; eye-peduncles long and slender, tentacles very short.

Jaw wide, low, slightly arcuate, ends blunt, but little attenuated.

Lingual membrane (Pl. IV. Fig. T) as usual in the genus. Teeth about 15—1—15, with about 7 perfect laterals. Centrals quite narrow, the reflected portion very small, tricuspid. Laterals quite broad, bicuspid. Marginals quadrate, low, wide, with one inner, long, oblique, blunt denticle, and several outer, small, irregular, blunt denticles. The outer lower edges of the centrals and laterals have the projecting or short reinforcements shown in the figures referred to above.

Though we retain the species in the genus *Pupa*, it must be remembered that as treated by Pfeiffer it would be placed in *Buliminus* of Albers and Martens. In general form of shell it certainly approaches *Buliminus montanus*, Drap.

Pupa modica, Gould.

Vol. III. Pl. LII. Fig. 2.

Shell small, delicate, elongated, ovate-conic, whitish or pale horn-colored, imperforate; whorls 5, convex, the apex of the spire acute; aperture expanded, peristome revolute, but not flattened, its right margin strongly curved above; throat destitute of teeth. Length, 2$\frac{1}{2}$ mill.; diameter, 1$\frac{3}{5}$ mill.

Pupa modica, Gould, Proc. Bost. Soc. Nat. Hist., III. 40 (1848); Terr. Moll., II. 318, Pl. LII. Fig. 2. — W. G. Binney, Terr. Moll., IV. 142; L. & Fr.-W. Sh., I. 240 (1869). — Pfeiffer, Mon. Hel. Viv., III. 533.

Bulimus modicus, Pfeiffer, Mon. Hel. Viv., IV. 414.

Pupilla modica, Tryon, Amer. Journ. Conch., III. 306 (1868).

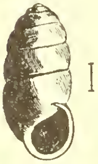
Southern Region, in Georgia, Florida, and Alabama.

The form and other characters of this shell are almost precisely those of *Pupa fallax*, except that it is only about half as large, and has about two whorls less to the spire. The aperture is somewhat more bell-shaped; and the peristome is thin and revolute instead of being thick and flattened.

Pupa Arizonensis, Gabb.

Shell rimate, oblong-fusiform, thin, delicately wrinkled, pellucid, horn-color; spire elongated, apex obtuse; whorls 5, convex, the last equalling one half the shell's length; aperture oblique, oval; peristome thickened, white, continuously slightly reflected, its ends approximating, joined by a light callus, that of the columella straight, dilated. Length, 4$\frac{1}{2}$, diameter, 2 mill.; aperture, 1$\frac{1}{2}$ long, 1 mill. wide.

Fig. 108.



Pupa Arizonensis.

Pupa (*Modicella*) *Arizonensis*, Gabb, Amer. Journ. Conch., II. 331, Pl. XXI. Fig. 6 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 240, Fig. 416 (1869).

Leucochila Arizonensis, Tryon, Amer. Journ. Conch., III. 305 (1868).

Arizona, at Fort Grant, junction of Arivapa and San Pedro Rivers; Nevada at White Pine: it thus appears to be a species of the Central Province.

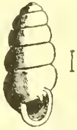
The description and figure are drawn from an authentic specimen. The species is less elongated, more blunt, and has more convex whorls than *Pupa fallax.*

Animal unobserved.

Pupa hordeacea, Gabb.

Shell rimate, cylindrical, thin, scarcely striate, pellucid, horn-color; spire elongated, apex obtuse; whorls 5, convex, the last equalling one third the shell's length; aperture truncate-ovate; peristome thickened, white, reflected, not continuous; one twisted, tooth-like, entering, prominent fold upon the parietal wall of the aperture, and one prominent upright tooth within the aperture at its base. Length, 2½ mill.; diameter, ¾ mill.

Fig. 109.



Pupa hordeacea.

Pupa hordacea, Gabb, Am. Journ. Conch., II. 331, Pl. XXI. Fig. 7 (1866).

Pupa hordeacea, W. G. Binney, L. & Fr.-W. Sh., I. 241, Fig. 417 (1869).

Leucochila hordacea, Tryon, Am. Journ. Conch., III. 306 (1868).

Arizona, at Fort Grant, junction of Arivapa and San Pedro Rivers; in the Central Province.

My description and figure are drawn from an authentic specimen.

Animal unobserved.

Pupa armifera, Say.

Vol. III. Pl. LXX. Fig. 4.

Shell cylindrical, subfusiform, smooth; whorls 6 to 7, convex, the three next the aperture of about equal diameter, the posterior three diminishing and forming a rather obtuse apex; suture impressed; peristome white, thin, subreflected, forming the whole outline of the aperture, except a small portion of the body-whorl, where a thin, testaceous deposit connects its two extremities; aperture lateral, nearly oval, deep, cup-shaped, and narrowing towards the throat, which is almost filled up by projecting teeth, white within; teeth commonly 4, one of which, affixed to the body-whorl, commences at the superior margin of the aperture, near the junction of the peristome and ultimate whorl, and runs backward and downward into the aperture, — it is prominent, lamelliform, irregular, has one or more sharp, projecting points, and is sometimes bifid; another, thick and massive, is situated deep in the throat, and marks internally the place of the umbilicus; and two others, projecting and tooth-like, are placed on the peristome at the base of the aperture, and point towards the centre of the aperture; base of the shell, from the umbilicus to the edge of the aperture, compressed, forming a short and obtuse keel; umbilicus a little expanded, and slightly perforate. Length, 4⅔, diameter, 2⅔ mill.; length of aperture, 1⅔ mill.

Pupa armifera, Say, Journ. Acad. Nat. Sci. Phila., II. 162 (1821); Binney's ed. 21. — Gould, Bost. Journ. Nat. Hist., III. 400, Pl. III. Fig. 10 (1840); IV. 359 (1843). — Adams, Vermont Mollusca, 157 (1842); Silliman's Journ., [I] XL. 271. — Pfeiffer, Symbolæ, II. 53; Mon. Hel. Viv., II. 357. — DeKay, N. Y. Moll., 52 (1843). — Binney, Terr. Moll., II. 320, Pl. LXX. Fig. 4. — Küster, in Chemnitz, ed. 2, 57, Pl. VII. Figs. 17-19. — W. G. Binney, Terr. Moll., IV. 142; L. & Fr.-W. Sh., I. 241 (1869). — Gould and Binney, Inv. of Mass., (2), 437 (1870).

Pupa rupicola, Pfeiffer, Symbolæ, II. 55, teste Pfeiffer, in Mon.

Leucochila armifera, Morse, Amer. Nat., 667, Fig. 55 (1868). — Tryon, Am. Journ. Conch., III. 306 (1868).

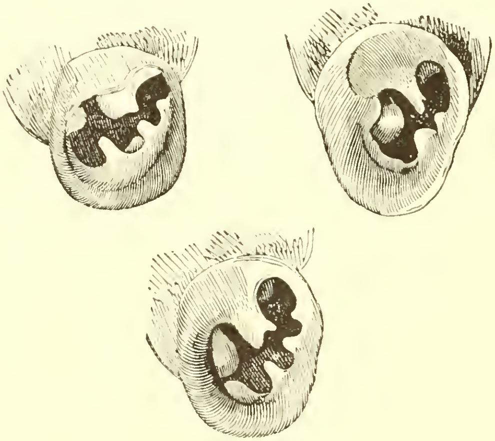
Pupa armigera, Potiez et Michaud, Galérie, I. 159, Pl. XVI. Figs. 1, 2.

Probably inhabits every State east of the Rocky Mountains; thus belongs to the Eastern Province.

Animal black; eye-peduncles long and slender; tentacles conical and prominent. Respiratory orifice very visible at the angle formed by the junction of the peristome with the body whorl.

The normal number of teeth, or that number which is most commonly observed in adult individuals, is certainly 4; but, in addition to those described, there is sometimes a small tubercle, or diminutive tooth, very near the junction of the peristome and body whorl, and more rarely another of the same description, at the base of the aperture, near the umbilical tooth. If those only are to be considered fully mature which possess all the teeth, then the species may be characterized as having 6 teeth in the aperture; but as one of them is nearly always, and another generally, wanting, the description here given is correct. The margin of the peristome is sometimes continuous entirely around the aperture.

Fig. 110.



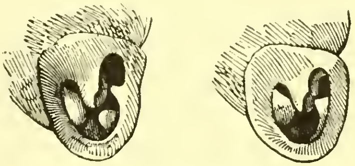
Pupa armifera.

Pupa contracta, Say.

Vol. III. Pl. LXX. Fig. 2.

Shell subconical; epidermis whitish horn-color; whorls between 5 and 6, very convex, diminishing regularly from the last whorl, which is somewhat ventricose, to the apex; suture well impressed; peristome white, thickened, somewhat reflected, its extremities connected by a raised, testaceous fold, making the margin of the aperture entire; aperture lateral, rather triangular or trilobate, more than half as wide as the body-whorl, expanded above and diminishing regularly into a very narrow throat, with 4 teeth, one upon the columella, large, coarse, and irregular, projecting into and very much filling up the aperture, and having a concavity on the side towards the peristome; another tuberculous, not large, more or less near the margin of the peristome; and two others, massive and prominent, deep seated in the throat, one being in the base behind the columellar tooth, and the other on the side of the umbilicus and apparently produced by the umbilical fold; umbilicus with a minute perforation; base of the shell with a sharp keel between the umbilicus and margin; last whorl impressed behind the peristome. Length, 3, diameter, 1$\frac{3}{4}$ mill.; of aperture, length, 1 mill.

Fig. 111.



Pupa contracta.

Pupa contracta, Say, Journ. Acad. Nat. Sci. Philad., II. 374 (1822); Binney's ed. 25 (*Carychium?*). — Gould, Bost. Journ. Nat. Hist., III. 399, Pl. III. Fig. 22 (1840); IV. 359 (1843); Invertebrata, 186, Fig. 117 (1841). — DeKay, N. Y. Moll., 49, Pl. IV. Fig. 47 (1843). — Adams, Vermont Mollusca, 157. — Pfeiffer, Symbolæ, II. 54; Mon. Hel. Viv., II. 356. — Küster, in Chemnitz, 2d ed. 96, tab. XIII. Figs. 16-18. — Binney, Terr. Moll., II. 324, Pl. LXX. Fig. 2. — W. G. Binney, T. M., IV. 143; L. & Fr.-W. Sh., I. 242 (1869). — Gould and Binney, Inv. of Mass., ed. 2, 438 (1870).

Pupa corticaria, Pfeiffer, Symbolæ, II. 54 (an var. β? Pfeiffer, l. c.).

Pupa deltostoma, Charpentier, in Chemnitz, ed. 2, p. 181, Pl. XXI. Figs. 17-19. — Pfeiffer, Mon. Hel. Viv., IV. 683.

Leucochila contracta, Morse, Amer. Nat., 666, Fig. 54 (1868). — Tryon, Am. Journ. Conch., III. 307 (1868).

Inhabits the whole of the Eastern Province.

Animal blackish above, foot light gray. Eye-peduncles long and slender, slightly curving; tentacles prominent and conical, pellucid at tips. Respiratory foramen visible in the external angle of aperture.

This is a well-defined species, always known by its subconical shape and triangular aperture, nearly filled up by the coarse, projecting, columellar tooth. The description here given applies to the most common form of the mature shell, as ascertained from the examination of more than one hundred specimens from different localities. Among a number of specimens there will of course be different degrees of development and consequent variation from the normal form. Specimens from particular localities seem always to be more delicate, and never to attain that coarseness of parts in the aperture which is common. There is sometimes a slight thickening of the left peristome near its extremity. Mature specimens vary considerably in size. The aperture is beautifully white within.

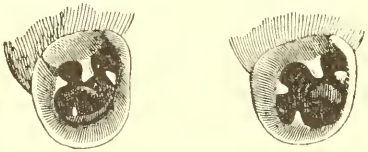
Genitalia, jaw, and dentition unknown.

Pupa rupicola, Say. [1]

Vol. III. Pl. LXX. Fig. 1.

Shell cylindrical, elongated; epidermis brownish horn-color; whorls 6, convex, the three anterior ones of nearly equal diameter, the three posterior diminishing very slightly, and forming an obtuse apex; suture deep; peristome brownish, thickened within, widely reflected; aperture lateral, semicircular, truncated above by the body-whorl; teeth 5, one on the middle of the columella prominent, compressed, emarginate in the middle, and often bicuspid; another at the termination of the axis, marking internally the situation of the umbilicus, conical, and often composed of two or more tubercles; a third in the base of the aperture, a fourth upon the peristome, and a fifth, often massive and prominent, deep in the fauces behind the columellar tooth; umbilicus minute. Length, 2½ mill.; diameter, 1 mill.

Fig. 112.



Pupa rupicola, enlarged.

Pupa rupicola, Say, Journ. Acad. Nat. Sci. Phila., II. 163 (1821); Binney's ed., 22 (*Carychium?*). — Gould, Bost. Journ. Nat. Hist., IV. 355, Pl. XVI. Fig. 13 (1843). — Pfeiffer, Mon. Hel. Viv., II. 358; III. 557, nec Symbolæ, II. 55; in Chemnitz, ed. 2, p. 123, Pl. XVI. Figs. 17-19. — DeKay, N. Y.

Moll., 52 (1843). — Binney, Terr. Moll., II. 341, Pl. LXX. Fig. 1. — W. G. Binney, Terr. Moll., IV. 145 ; L. & Fr.-W. Sh., I. 243 (1868).

Pupa procera, Gould, Bost. Journ. Nat. Hist., III. 401, Pl. III. Fig. 12 (1840). — Küster, in Chemnitz, 58, Pl. VII. Figs. 20, 21. — Pfeiffer, Mon. Hel. Viv., II. 360.

Pupa carinata, Gould (olim), 1842, Bost. Journ. Nat. Hist., IV. 1, cover, p. 3 ; see also IV. 359 (1843). — Pfeiffer, Mon. Hel. Viv., II. 359 ; III. 557.

Pupa gibbosa, Küster, in Chemnitz, ed. 2, p. 123, Pl. XVI. Figs. 13-16.

Pupa minuta (Say), Pfeiffer, Mon. Hel. Viv., II. 356 ; III. 555 ; Symb., II. 54.

Vertigo rupicola, Binney, *l. c.*

Leucochila rupicola, Tryon, Am. Journ. Conch., III. 307 (1868).

From Key West to Arkansas and New England ; Louisiana ; Texas. It may, therefore, be said to inhabit all of the Eastern Province.

Mr. Say noticed the resemblance between this species and *P. corticaria;* future observations will, I believe, prove them to be identical. That *procera* and *rupicola* are synonymous is fully shown by the comparison of numerous specimens. The length of the spiral cylinder varies considerably. The characters of the aperture are constant ; but the teeth, except those on the transverse margin and at the extremity of the axis, are frequently wanting ; its outline is well rounded, and the peristome broadly expanded. There is often an abrupt curve of the outer peristome between the tooth of that side and its junction with the body-whorl. The upper boundary of the aperture is distinctly marked by the body-whorl, which makes a horizontal truncature of the superior part of the oval. The teeth, except the two constant ones, are deeply seated in the throat, and cannot always be seen without considerable attention.

Jaw low, wide, slightly arcuate ; ends but little attenuated, blunt ; no median projection to cutting edge.

Lingual membrane as usual in the genus (see Pl. IV. Fig. S). The cusps on the laterals, however, are very much stouter. There are 5 perfect laterals ; teeth, 11—1—11.

Genitalia not observed.

Pupa corticaria, Say.

Vol. III. Pl. LXXII. Fig. 9.

Shell whitish, shining, cylindrical, obtuse at the apex ; whorls rather more than 5, convex ; suture well impressed ; aperture lateral, two thirds as wide as the last whorl, suborbicular, with a single tooth (sometimes two) on the parietal wall, near the centre, and a tooth-like enlargement near the umbilical termination of the peristome, which is white, reflected ; umbilicus very minutely perforated. Length, 2½ mill. ; diameter, 1 mill.

Odostomia corticaria, Say, Nich. Encycl., IV. Pl. IV. Fig. 5 ; ed. 1 (1817) ; ed. 2 (1818) ; Binney's ed. 7, Pl. LXXII. Fig. 5.

Pupa corticaria, Say, Nich. Encycl., IV. ed. 3, 1819, Pl. IV. Fig. 5. — Gould, Bost. Journ. Nat. Hist., III. 397, Pl. III. Fig. 19 (1840); IV. 358 (1843). — DeKay, N. Y. Moll. 50, Pl. IV. Fig. 49 (1843). — Küster, in Chemnitz, 2d ed., p. 27, Tab. XIII. Figs. 19–20. — Pfeiffer, Mon. Hel. Viv., II. 328. — Binney, Terr. Moll., II. 339, Pl. LXXII. Fig. 4. — W. G. Binney, Terr. Moll., IV. 146; L. & Fr.-W. Sh., I. 244 (1869). — Gould and Binney, Invert. of Mass. [2], 439 (1870).

Carychium corticaria, Férussac, Prodr., No. 3 (no descr.).

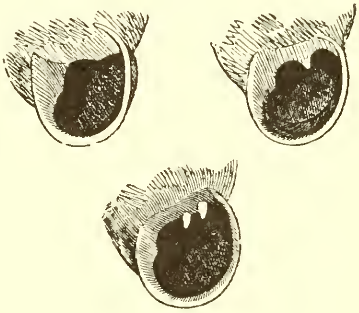
Leucochila corticaria, Morse, Journ. Portl. Soc., I. 36, Fig. 87; Pl. X. Fig. 88 (1864). — Tryon, Am. Journ. Conch., III. 307 (1868).

From Maine and Wisconsin to South Carolina and Mississippi. I believe, therefore, that it will prove to be found over all the Eastern Province.

Animal whitish, darker upon the head and eye-peduncles; the latter are long and club-shaped; tentacles short, thick.

This is a very thin and delicate shell, and has a peculiar transparency, resembling spermaceti. The aperture is somewhat circular, the upper part being interrupted by the last whorl, and the extremities of the peristome not being connected. The smaller tooth is often wanting, and sometimes both. In the number and position of the teeth it somewhat resembles *Carychium exiguum*; but it is less fusiform, and more cylindrical. In general outline, and in the shape of the aperture, it very much resembles *P. rupicola*, but the parts within the aperture are very different. It is, however, just what the immature shell of that species might be supposed to be, when the dentiform deposits were only commenced, and the peristome thin and unfinished. I am much inclined to believe that it is only a young shell. In the great number of specimens which I possess, the teeth are only rudimentary.

Fig. 113.



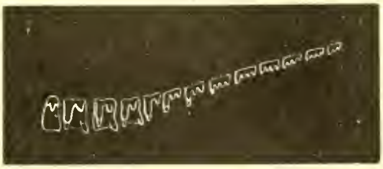
Pupa corticaria.

Jaw slightly arcuate, tapering towards the pointed ends, the centre of the anterior surface marked with longitudinal striæ; concave margin with a slight, broad, median projection.

Lingual membrane with 25 teeth (12—1—12) in each row. Central teeth very small, tricuspid; laterals bicuspid, modified into serrated marginals. (Fig. 14.)

Genitalia unobserved.

Fig. 114.

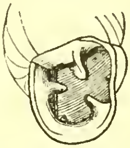


Lingual dentition of *Pupa corticaria.*

Pupa pellucida, PFR.

Shell subperforate, cylindrical, thin, pellucid, shining, pale yellow, spire somewhat attenuated, apex obtuse; whorls 5, convex, the last flatter than the penultimate; aperture semi-oval, with 5 teeth; single strong teeth on columella and parietal wall of aperture, two moderate ones on right side, a fifth small basal one within the aperture; peristome simple, its right end expanded, its columellar end reflected. Length, 2 mill.; diameter, scarcely 1 mill.; aperture, scarcely $\frac{2}{3}$ mill. long.

Fig. 115.



Pupa pellucida.

Pupa pellucida, PFEIFFER, Symbolæ, I. 46; Mon. Hel. Viv., II, 360; in RÖMER's Texas, 456. — KÜSTER, in CHEMNITZ, ed. 2. 89, Pl. XII. Figs. 24, 25. — W. G. BINNEY, Terr. Moll., IV. 147; L. & Fr.-W. Sh., I. 246 (1869).

Pupa servilis, GOULD, Bost. Journ. Nat. Hist., IV. 356, Pl. XVI. Fig. 14. — PFEIFFER, Mon. Hel. Viv., II. 360.

Pupa Rüsei, PFEIFFER, olim, Mon. Hel. Viv., III. 532. — KÜSTER, in CHEMNITZ, ed. 2, 176, Pl. XXI. Figs. 13, 14.

Leucochila pellucida, TRYON, Amer. Journ. Conch., IV. (1868).

A West Indian species quoted by Pfeiffer from Texas, but not elsewhere noticed; it is probably confined to the Texan Subregion. I have seen no specimens of it. Fig. 115 is a fac-simile of that of *P. servilis.*

Animal unobserved.

Pupa borealis, MORELET.

Shell rimate, ovate-oblong, shining, diaphanous, reddish horn-color, with miscroscopic revolving striæ; whorls 6, rather convex, the last compressed below, forming a medium-sized excavation; aperture somewhat rounded-oval, moderate, four-toothed, one deep, foldlike, on the parietal wall, one columellar, the rest smaller, palatal; peristome simple, straight, its columellar extremity slightly dilated above. Length, 3 mill.; width, $1\frac{1}{2}$ mill. (Morelet.)

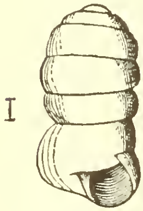
Pupa borealis, MORELET, Journ. de Conch., VII. 9 (1858).

An Asiatic species, said also to be found in Alaska.

Animal unknown.

Pupa alticola, INGERSOLL.

Fig. 116.



Pupa alticola.

Shell perforate, straight, two and one half times as long as broad, densely striate, subtranslucent, chestnut-brown, apex obtuse; whorls 6 or 7, convex, the middle three of the spire equal, causing a parallelism in the sides of the shell, the last noticeably greater, expanding toward the aperture, not closely appressed to the body-whorl; suture deeply impressed; aperture small, oblique, subtriangular, margins connected by a thin deposit, without internal processes; peristome simple, somewhat reflected over the umbilicus.

Cunningham Gulch, Colorado; Rio La Plata.

It will not be difficult to recognize this species by its parallel sides, base-like expansion of the last whorl, coarse incremental lines, and edentate aperture. It seems to be an essentially alpine species, none having been found at an elevation less than 8,000 to 9,000 feet. It was plenty in the localities mentioned above. (Ingersoll.)

Animal not observed.

Pupilla alticola, INGERSOLL, Bulletin U. S. Geol. Geogr. Surv. of the Terr., No. 2, p. 128 (1875); ed. 2 (1876), p. 391, Fig.

A species of the Central Region.

Figure 116 is drawn from an authentic specimen.

DOUBTFUL AND SPURIOUS SPECIES OF PUPA.

Pupa placida, SAY, is probably an accidentally introduced specimen of *Buliminus obscurus*, MÜLLER (see Boston Proc., I. 105). The original description here follows: —

Shell dextral, cylindric-conic, pale yellowish horn-color; apex whitish, obtuse; whorls 6½, somewhat wrinkled; suture moderately impressed; aperture unarmed, longitudinally oval, truncate a little obliquely above by the penultimate volution; columella so recurved as almost to conceal the umbilicus; labrum, with the exception of the superior portion, appearing a little recurved when viewed in front, but when viewed in profile, this recurvature is hardly perceptible; umbilicus very narrow.

Length over three tenths of an inch. Inhabits Massachusetts.

For this shell I am indebted to Dr. T. W. Harris, of Milton, from whom I have received many interesting species of our more northern regions. At first view it might be mistaken for the *P. marginata*, Nob., but it is quadruple the size, and the labrum is not reflected and thickened. (Say.)

Pupa placida, SAY, New Harmony Diss., II. 230 (1829); Descr. 24 (1840); BINNEY'S ed., 39. — W. G. BINNEY, Terr. Moll., IV. 145.

Pupa fallax, DEKAY, N. Y. Moll., 51. — GOULD, Invert., 192.

Pupa fallax, *β*, PFEIFFER, Mon. Hel. Viv., II. 309.

Bulimus hordeanus? DEKAY, l. c. — BINNEY, Bost. Proc., I. 105.

Bulimus obscurus, GOULD, Mon. Pupa, p. 17. — PFEIFFER, III. 350, on DEKAY'S authority.

Pupa costulata, MIGHELS, is the same as *Acanthinula harpa.*

Pupa exigua, SAY, etc., is the same as *Carychium exiguum.* (See Vol. IV.)

Pupa Gouldii, BINNEY, etc., is the same as *Vertigo Gouldi.*

Pupa milium, GOULD, is the same as *Vertigo milium.*

Pupa modesta, SAY, etc., is the same as *Vertigo ovata.*

Pupa ovata, GOULD, etc., is the same as *Vertigo ovata.*

Pupa ovulum, PFEIFFER, is the same as *Vertigo ovata.*

Pupa simplex, GOULD, etc., is the same as *Vertigo simplex.*

Pupa incana, = *Strophia.*

Pupa unicarinata, BINNEY, Terr. Moll., I., is the same as *Macroceramus Kieneri.*

Pupa Nebrascana, of WARREN's Report of Surveys, etc., Ex. Doc., II. Pt. 2, 35th Cong., 1859, p. 725, may perhaps be *P. contracta.*

P. marginata, DRAP., credited to North America by PRESTWICH, Quart. Journ. Geol. Soc., XXVII. 493.

FOSSIL SPECIES OF PUPA.

Pupa helicoides, MEEK and HAYDEN, Proc. Acad. Nat. Sci. Philad., VIII. 118.

Pupa vetusta, DAWSON, Geol. Soc. Proc., 1852, IX. 60, Pl. IV. (*Dendropupa*, OWEN).

Pupa Vermilionensis, coal of Illinois, see Silliman's Amer. Journ. of Science for Aug., 1872.

VERTIGO, MÜLL.

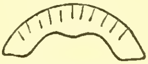
Animal as in *Pupa*, but tentacles wanting.

Shell deeply rimate, ovate, apex acuminate obtuse; whorls 5 – 6, the last rounded; aperture semi-oval, with four to seven folds; peristome scarcely expanded, white-lipped.

The distribution of the genus is world-wide.

Jaw more or less arched, ends but little attenuated, blunt; anterior surface with delicate vertical striæ; cutting margin with a more or less developed median projection.

Fig. 117.



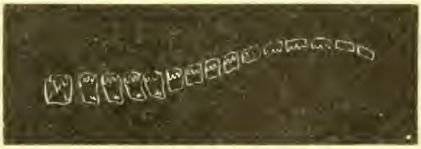
Jaw of *Vertigo ovata* (Morse).

I have given Fig. 117 copied from that of Morse. In the L. & Fr.-W. Sh. N. A., I., will be found other figures of jaws showing the variations in outline found in the genus. I have personally examined the jaw in none of our species.

For the characters of the lingual dentition I am also entirely dependent on Morse.

Fig. 118 shows the general arrangement of the teeth on the membrane. The membrane is long and narrow. The central teeth have a base of attach-

Fig. 118.



Lingual dentition of *Vertigo ovata* (Morse) ment higher than wide, subrectangular. The whole upper margin is broadly reflected. The reflection is very short, and bears three short stout cusps, the central the longest, each cusp bearing (I presume) a distinct cutting point. The central tooth, in those species whose dentition is known to me, is as large as the laterals, and not smaller, as seems to be the rule in our species of *Pupa*. The lateral teeth are like the centrals, but asymmetrical. The reflected portion is small, tricuspid, or bicuspid. The marginals are wide, low, with a broad, irregular denticulated reflection.

SUBGENUS ISTHMIA, GRAY.

Shell dextral.

Vertigo Gouldi, BINNEY.

Vol. III. Pl. LXXI. Fig. 2.

Shell light chestnut, cylindrical ovate; whorls rather more than 4, ventricose, the last occupying nearly one half the length of the axis; aperture lateral, composed of two unequal curves meeting in the centre of the peristome, with five prominent, white teeth, namely, one upon the transverse margin, two upon the umbilical margin, and two upon the labial margin; peristome thickened, not reflected; umbilicus a little open. Length, 2 mill.; diameter, 1 mill.; aperture, $\frac{2}{3}$ mill. long.

Pupa Gouldii, BINNEY, Proc. Bost. Soc. Nat. Hist., I. 105 (1843); Terr. Moll., II. 332, Pl. LXXI. Fig. 2. — GOULD, Bost. Journ. Nat. Hist., IV. 352, Pl. XVI. Fig. 9 (1843). — PFEIFFER, Mon. Hel. Viv., II. 358; KÜSTER in CHEMNITZ, ed. 2, 124, Pl. XVI. Figs. 20-23.

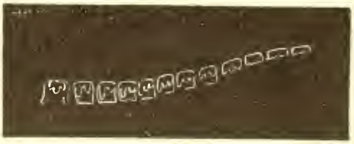
Vertigo Gouldii, STIMPSON, Shells of N. E., 53 (no descr.). — W. G. BINNEY, Terr. Moll., IV. 148; L. & Fr.-W. Sh., I. 250 (1869). — TRYON, Am. Journ. Conch., III. 309 (1868). — GOULD and BINNEY, Inv., 440, Fig. 701 (1870). — MORSE, Amer. Nat., I. 669, Fig. 60 (1868).

Isthmia Gouldii, MORSE, Journ. Portl. Soc., I. 38, Fig. 95, Pl. X. Fig. 96 (1864).

From Maryland through New England. It therefore belongs to the Northern Region, extending along the Appalachians into the Interior Region.

Animal with no tentacles; black above, foot gray, tapering posteriorly, and rounded at the extremity; carries the shell at an angle of about forty-five degrees.

Fig. 119.



Lingual dentition of *Vertigo Gouldi* (Morse).

Jaw scarcely arcuate, of equal size throughout, ends rounded, anterior surface with longitudinal lines and transverse striæ; concave margin simple, no median projection.

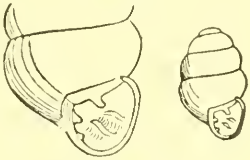
Lingual membrane with 75 rows, each row containing 23 (11 — 1 — 11) short and stout teeth, 7 perfect laterals. Centrals tricuspid; laterals bicuspid; marginals serrated.

It has been referred to *V. Alpestris*, Ald. by Gwyn Jeffreys, 1872, p. 246, An. Mag. Nat. Hist.

Vertigo Bollesiana, Morse.

Shell minutely perforate, cylindrical-ovate, delicately striated, subtranslucent; apex obtuse; suture well defined; whorls 4, subconvex; aperture suborbicular, somewhat flattened on its outer edge; with 5 teeth, one prominent and rather curved on the parietal margin, two similar in form, the lower one the smaller, on the columellar margin, and two slightly elevated lamelliform teeth within and at the base; peristome subreflected and thickened. Length, .065 inch; breadth, .035 inch. (Morse.)

Fig. 120.



Vertigo Bollesiana.

Isthmia Bollesiana, Morse, Ann. N. Y. Lyc., VIII. 209, Figs. 4-6 (Nov. 1865).

Vertigo Bollesiana, Morse, Amer. Nat., I. 669, Figs. 63-64 (1868). — W. G. Binney, L. & Fr.-W. Sh., I. 250 (1869). — Gould and Binney, Inv., 442, Fig. 703 (1870). — Tryon, Am. Journ. Conch., III. Pt. 4, p. 308, Pl. XV. Fig. 25 (1868).

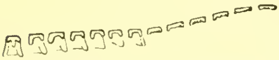
New England; New York; Virginia. Distribution, therefore, like the last species.

Animal unobserved.

Jaw of the same width throughout, slightly rounded at the ends; cutting edge without projections, finely striated.

Lingual membrane with 88 rows of (12—1—12) teeth; base of attachment notched at outer posterior corners; square, widening posteriorly, armed with three minute denticles, central one largest; laterals having two minute denticles apart, outer denticle nearly obsolete; marginals scarcely notched.

Fig. 121.



Lingual membrane of *Vertigo Bollesiana* (Morse).

A comparison of this description and figure of dentition with that of Lehmann (Pl. XIV. Fig. 53) will prove that this species cannot be identical with *P. pygmæa* of Europe, as has been suggested by Mr. Gwyn Jeffreys (Ann. Mag. Nat. Hist., 1872, 246).

Vertigo milium, Gould.

Vol. III. Pl. LXXI. Fig. 1.

Shell very minute, subcylindrical, diminishing equally to both extremities; epidermis dark-amber, or chestnut-color; whorls 5, rounded, very minutely striated, decreasing slightly to the apex, which is obtuse; suture deep; peristome white, slightly reflected; aperture lateral, half the width of the last whorl, within brownish, general shape semicircular, truncated abruptly and directly by the last whorl, a testaceous deposit upon which forms the transverse margin, and connects the two extremities of the peristome; circumference made up of two curves of different radius uniting in the peristome, where the junction causes an angle projecting inwards, the smaller curve comprising about one fourth part, and forming the superior portion of the peristome; teeth 6, two on the transverse margin, sharp, projecting, and tooth-like; one in the angle between the columellar and transverse margins, broad, massive, and prominent, with occasionally one or more tubercles about its base; one on the lower part of the columellar margin; two on the peristome, in the base of the aperture, and at the junction of the two curves; umbilicus rather wide. Length, $\frac{4}{5}$ mill.; diameter, $\frac{3}{5}$ mill.

> *Pupa milium*, GOULD, Bost. Journ. Nat. Hist., III. 402, Pl. III. Fig. 23 (1840); IV. 359 (1843); Invertebrata, 187, Fig. 118 (1841). — DEKAY, N. Y. Moll., 48, Pl. IV. Fig. 44 (1843). — ADAMS, Vermont Mollusca, 157 (1842). — PFEIFFER, Mon. Hel. Viv., II. 362. — BINNEY, Terr. Moll., II. 337, Pl. LXXI. Fig. 1. — KÜSTER, in CHEMNITZ, ed. 2, 119, Pl. XV. Fig. 39-42.
>
> *Vertigo milium*, W. G. BINNEY, Terr. Moll., IV. 148. — MORSE, Amer. Nat., I. 669, Figs. 65, 66 (1868).

From New England to Texas. A species of the Eastern Province.

Animal very light gray, darkest above; foot thick, broadest behind the middle, tapering suddenly to a point. Eye-peduncles somewhat globular at tips, in the centre of which are the eye-spots; no tentacles.

The most minute of our species, but though the eye cannot, without the aid of the microscope, detect its characters, they are very strongly defined. The parts about the aperture are particularly well-developed, the teeth being long, compressed, and sharp, and the transverse margin distinctly bounded. Professor Adams mentions that twelve mature specimens weighed less than a sixteenth of a grain. It is found under or among dead leaves. It is gregarious in its habits; when one is found, many others may be quite certainly found near it.

Vertigo ovata, SAY.

Vol. III. Pl. LXXI. Fig. 4.

Shell minute, ovate-conic, ventricose, dark amber-colored; whorls 5, very convex, the last much inflated, diminishing rather rapidly to a somewhat acute apex, with an indentation towards the aperture; suture rather deep; peristome thin, somewhat expanded, with a groove behind and a thickening within; aperture in general outline semicircular, the curve consisting of segments of two different-sized, but well-defined circles, the smaller on the right at the junction of the peristome and body-whorl, comprising about one fourth of the whole contour, and forming an angle at their junction; teeth generally 6, two on the transverse margin, two on the columellar margin, the upper of which is massive, the lower pointed, and two on the peristome, in the base and at the junction of the two curves, sharp and prominent; umbilicus expanded. Length, 3 mill.; diameter, $1\frac{1}{2}$ mill.; aperture, 1 mill. long.

> *Vertigo ovata*, SAY, Journn. Acad. Nat. Sci. Philad., II. 375 (1822); ed. BINNEY, 26. — BINNEY, Terr. Moll., II. 334, Pl. LXXI. Fig. 4. — W. G. BINNEY, Terr.

Moll., IV. 148; L. & Fr.-W. Sh., I. 253 (1869). — Morse, Amer. Nat., I. 668, Figs. 57, 58 (1868). — Tryon, Amer. Journ. Conch., III. 310, 22 (1868). — Gould and Binney, Inv., 442, Fig. 704 (1870). — Fischer and Crosse, Moll. Mex. et Guat., 310 (1870).

Vertigo tridentata, Wolf, Am. Journ. Conch., V. 198, Pl. XVII. Fig. 1.

Pupa ovata, Gould, Bost. Journ. Nat. Hist., IV. 350, Pl. XVI. Figs. 7, 8 (1843). — DeKay, N. Y. Moll., 50, Pl. IV. Fig. 50 (1843). — Adams, Vermont Mollusca, 157 (1842); Silliman's Journal [i], XL. 271. — Küster, in Chemnitz, ed. 2, 118, Pl. XIV. Figs. 1, 2; XV. Figs. 35, 38. — Pfeiffer, Mon. Hel. Viv., II. 360; Symbolæ, II. 54.

Pupa modesta, Say, Long's Exped., II. 25, Pl. XV. Fig. 5 (1824); ed. Binney, 32, Pl. LXXIV. Fig. 5. — Gould, Invertebrata, 188, Fig. 119 (1841).

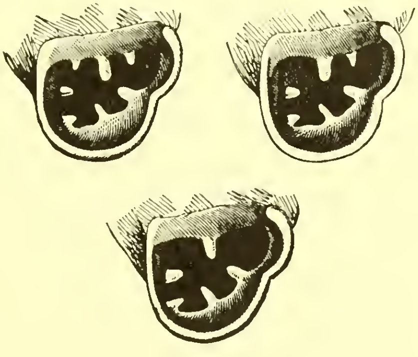
Pupa ovulum, Pfeiffer, olim, Symbolæ, I. 46.

Isthmia ovata, Morse, Journ. Portl. Soc., I. 38, Fig. 93; Pl. X. Fig. 94 (1864).

Over all the Eastern Province, having been found from Maine to Texas. Also in the Central Province in Arizona. For its presence in Europe, see Jensen, Bidr. til Kristianiafjorden Moll., 68, 80. Also quoted from Mexico and Cuba.

Jaw arcuate, of uniform breadth, ends square and horizontal; anterior surface with longitudinal wrinkles; concave margin simple, with a median projection.

Fig. 122.



Vertigo ovata.

Lingual membrane with 90 rows of 29 teeth (14—1—14), 9 perfect laterals; centrals and laterals triscuspid, marginals serrated. (Fig. 118, p. 213.)

Head and back deep cherry-red, posterior part of foot bluish, base whitish. Eye-peduncles larger towards the extremities, or remarkably club-shaped; ocular points distinct. The anterior extremity of the foot is dilated and trilobate, the middle lobe minute, lateral lobes rounded. Length rather greater than that of the axis of the shell.

Of forty specimens of this shell examined with the aid of a microscope, one had a single tooth, two had three teeth, and twenty-eight had two teeth, upon the transverse margin, the one nearest the centre being always largest and most prominent; and all of them had the bilobate, or double curved aperture, and the irregular indentation upon the outer whorl, near the peristome. A single specimen had three teeth upon the peristome, and three upon the transverse margin, making, with two upon the columellar margin, eight in all. The semicircular mouth is abruptly truncated by the last whorl, which forms a distinct and nearly transverse limit. The peristome is thin and a little turned outwards, its edge is often whitish, but within it is brownish, and often thickened. The indentation of the last whorl, terminating at the angle of the peristome, is a prominent character. The teeth of the peristome are often curved towards the centre of the aperture.

The motion of the animal, when in progress, is rapid, but awkward. The proboscis, which is long and projectile, seems to be thrust forward, and attached, and the rest of the foot drawn up to it, reminding one of the motion of a caterpillar, the shell at the same time rolling from side to side. The adherent forces of the animal evidently lie in the anterior part of the foot.

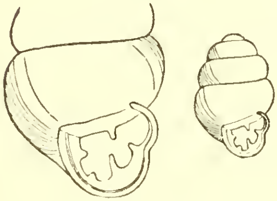
This is one of the more aquatic species, and is found under dead leaves and sticks, and on the stems of plants, at the margin of rivulets and ponds.

The species has been referred to *P. antivertigo*, but the figure of the dentition of that species given by Lehmann (Pl. XIV. Fig. 52) does not sustain the theory of identity.

Vertigo ventricosa, Morse.

Shell umbilicate, ovate-conic, smooth, polished; apex obtuse; suture deep; whorls 4, convex; aperture semicircular, with 5 teeth, one prominent on the parietal margin, two smaller on the columellar margin, and two prominent within, contracting the aperture at the base; peristome widely reflected, the right margin flexuose, within thickened and colored. Length, .07 inch, breadth, .045 inch. (Morse.)

Fig. 123.



Vertigo ventricosa.

Isthmia ventricosa, Morse, Ann. N. Y. Lyc., VIII. 1, Figs. 1-3 (Nov. 1865).

Vertigo ventricosa, Morse, Amer. Nat., I. 669, Figs. 61, 62 (1868). — W. G. Binney, L. & Fr.-W. Sh., I. 253 (1869). — Tryon, Amer. Journ. Conch., III. 310 (1868). — Gould and Binney, Inv., 443, Fig. 705 (1870).

Maine, New Hampshire, and New York; a species of the Northern Region.

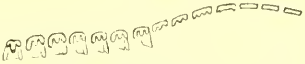
I have not seen this species. Mr. Morse says it has been confounded with *V. ovata*, but is one fourth smaller, has one whorl less, and a more circular columellar margin to the aperture.

Jaw wide, narrow, without median projection, but slightly curving at ends; cutting edge regularly waved.

Lingual formula 98 (13—1—13), with 6 perfect laterals; central and lateral bases of attachment notched at outer lower corners; central square, having three small denticles; indented at upper margin; laterals tricuspid, inner denticle largest; marginals minutely serrate.

Referred to *V. Moulinsiana*, Dupuy, by Gwyn, Jeffreys (l. c.), 246.

Fig. 124.



Lingual membrane of *Vertigo ventricosa* (Morse).

Vertigo simplex, Gould.

Vol. III. Pl. LXXII. Fig. 3.

Shell minute, cylindrical, obtuse at apex, smooth, chestnut-color; whorls 5, well rounded, separated by a deep suture; aperture circular, the peristome nearly continuous, simple or scarcely everted, except at its columellar margin, where it partially conceals a small umbilicus; no trace of a tooth has been detected in any specimen. Length, $1\frac{3}{5}$ mill.; breadth half as great.

Pupa simplex, Gould, Bost. Journ. Nat. Hist., III. 403, Pl. III. Fig. 21 (1840); IV. 359 (1843); Invertebrata, 190, Fig. 121 (1841). — Pfeiffer, Mon. Hel. Viv., II. 302. — DeKay, N. Y. Moll., 52, Pl. XXXVI. Fig. 347 (1843). — Binney, Terr. Moll., II. 343, Pl. LXXII. Fig. 3.

Vertigo simplex, Stimpson, Shells of New England, 53 (no descr.). — W. G. Binney, Terr. Moll., IV. 148; L. & Fr.-W. Sh., I. 254 (1869). — Morse, Amer. Nat., I. 670, Figs. 67, 68 (1868). — Tryon, Amer. Journ. Conch., III. 310 (1868). — Gould and Binney, Inv. of Mass., ed. 2, 444 (1870).

Canada and New England, a species of the Northern Region.

Animal dark gray above, light gray and pellucid below; foot moderately long, trilobate anteriorly, the middle lobe minute. Eye-peduncles usually clavate, sometimes very decidedly. No tentacles. Shell carried perpendicularly, or even inclined forwards. Active in movement.

Referred to *V. edentula*, Drap., by Gwyn Jeffreys, Ann. Mag. Nat. Hist., 1872, 246.

Spurious Species of Vertigo.

Vertigo contracta, Adams, Gen. Rec. Moll., is the same as *Pupa contracta*.
Vertigo decora, Adams, Gen. Rec. Moll., is the same as *Pupa decora*.
Vertigo minuta, Adams, Gen. Rec. Moll., is the same as *Pupa rupicola*.
Vertigo pentodon, Say, is the same as *Pupa pentodon*.
Vertigo rupicola, Binney, is the same as *Pupa rupicola*.
Vertigo corticaria, Binney, is the same as *Pupa corticaria*.

STROPHIA, Albers.

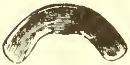
Animal heliciform, blunt before, pointed behind; mantle posterior, protected by a shell; respiratory and anal orifices on the right of the mantle, under the peristome of the shell; generative orifice behind the right eye-peduncle; no caudal mucus pore or locomotive disk.

Shell rimate, cylindrical or oblong-ovate, perpendicularly costulate or ribbed, solid, white, often variegated with red; whorls 9 – 12, the last narrowed towards the base, often ascending; aperture semi-oval, usually bluish-brown within; columella with a dentiform fold, parietal wall furnished with an internal denticle; peristome thickened, reflexed, its margins connected by a somewhat heavy callus.

A West-Indian genus, found also in the Florida Subregion.

But one species, *S. incana*, Binn., is found within our limits. I have found it to agree in the characters of its jaw and lingual membrane with the extralimital species which I have examined, *S. iostoma, mumia*, and *decumana*. Semper, however (Phil. Arch. 128), describes the jaw of *S. uva* as being without median projection to its cutting edge; that character, therefore, cannot be considered generic.

Fig. 125.



Jaw of *S. incana.*

Jaw of *S. incana* (Fig. 125) arcuate, thick, coarse, of about equal height to its bluntly truncated ends; cutting edge with a slightly produced median projection. Anterior surface without ribs.

Lingual membrane arranged as in *Patula* (see Pl. V. Fig. A) with 27—1—27 teeth. The change from laterals to marginals is as shown in the ninth and tenth tooth. There is the usual splitting of the inner cutting point beyond the ninth tooth. The extreme marginals are low, wide, with one inner, long, bluntly bifid cutting point and one outer, short. All the changes from centrals to extreme marginals are shown in the figures.

The splitting of the inner cutting point of the marginals was not detected by me before in *S. iostoma* and *mumia*. I have, however, lately found it in those species.

Strophia incana, Binney.

Vol. III. Pl. LXVIII.

Shell deeply rimate, cylindrically oblong, solid, smooth or delicately striate, shining, chalky; spire elongate, gradually attenuated into a rather acute cone; suture light, margined; whorls 11, flat, very gradually increasing, the last scarcely equalling or shorter than the length, wrinkled anteriorly, more or less arcuately ascending, at base subcompressed; aperture small, roundly lunate, light flesh-color within, furnished with a moderate deeply seated parietal tooth and an obsolete columellar fold; peristome somewhat thickened, shortly reflected all round, its terminations joined by a thin callus, that of the columella dilated and arched above. Length, 26 mill.; diameter, 10 mill.; of aperture, length, 8 – 9 mill.; diameter, 7 – 8 mill.

A variety has irregular longitudinal streaks of reddish-brown. (Fig. 126.)

Pupa incana, Binney, Terr. Moll., I. 109; III. Pl. LXVIII. — Leidy, T. M. U. S., I. Pl. XV. Figs. 2-4, anat. — Pfeiffer, Mal. Blätt., II. 13; Mon. Hel. Viv., IV. 657. — W. G. Binney, Terr. Moll., IV. 140, Pl. LXXIX. Fig. 17; L. & Fr.-W. Sh., I. 247, Fig. 430 (1869). — Tryon, Amer. Journ. Conch., III. 308 (1868).

Pupa mumia, Potiez and Michaud, Gal., I. 169, Pl. XVII. Figs. 1-2 (teste Pfr.).

Pupa maritima, γ, Pfeiffer, Mon. Hel. Viv., III. 539. — Gould, in Terr. Moll. II. 316.

Pupa detrita, Shuttleworth, MS., Pfeiffer, in Mal. Blätt., I. 158 (1853); I. 205 (1854), Pl. III. Figs. 9, 10.

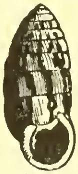
A Cuban and Bahamas species, found in the Florida Subregion, both on the southern part of the mainland, and on the Keys, from Cape Florida to Key West.

Animal whitish, brownish, smoky, or nearly black, darker on the back and upper part of head. Body finely granulated, the granules arranged in regular lines longitudinally, making the surface look as if minutely and longitudinally furrowed. Eye-peduncles rather short, slender, bulbous at the extremities; tentacles very short.

This species is found plentifully at Key West, where it inhabits low grounds near salt-water ponds. It attaches itself to saline plants, a few inches from the soil. At other times it retreats under stones. It is probably confined to the vicinity of the ocean. It has also been found on other neighboring Keys, and on the mainland from Key West to Cape Florida. The animal varies much in color; it is shy when kept in confinement. In winter it forms a membranous epiphragm.

The general appearance of this shell is cylindrical, with both extremities obtuse. The width of the central whorls is nearly uniform; the upper only become gradually narrower to the apex. The number of whorls is usually about 9, but sometimes 12; and the progressive increase of the width of the whorl, in revolving from the apex to the aperture, though regular in each specimen, differs so much in different specimens, that some shells are very short and robust, while others are long and fusiform. The whorls are nearly flat, the surface shining, and marked with numerous angular striæ, which, on the back and last whorl, attain sometimes the prominence of wrinkles. The peristome is often very thick; it is not added until the shell has acquired at least seven or eight full volutions. The outline of the external aperture is an oval, whose greatest diameter is parallel with the axis of the shell, truncated obliquely by the columellar margin; internally it is modified by a lamellar tooth or fold on its superior parietes, and another marking the depression of the axis; when these are prominent, the outline of the throat of the aperture is somewhat trilobate. One or both of the teeth are sometimes wanting. The apex of the spire is corneous. Its color is chalky or horny white, with frequently a livid brown tint beneath.

Fig 126.



S. incana, var.

A variety with longitudinal rufous bands is also figured above.

Jaw: see p. 220.

Lingual membrane with 129 rows of 24—1—24 teeth each. See p. 220.

The complete anatomy, including genitalia, is figured by Leidy (Vol. I. Pl. XV. Figs. 2–4). The penis sac is short, narrow, and cylindrical. The vas deferens is of a very great length when compared with what it is usually in the other genera. Its lower part, about the length of the penis, is dilated to the size of the latter organ, is strongly muscular, and terminates at the base of the penis sac. The retractor muscle is inserted into the summit of the latter. The lining membrane of the penis sac presents a single, longitudinal fold. At the base of the penis sac is a short, muscular sac, or protuberance, probably a dart sac, although the individual dissected possessed no such instrument. The genital bladder is oval; its duct is as long as the oviduct, and midway receives a long, narrow duct, derived from a granular, glandular organ combined with the testicle in the posterior lobe of the liver.

(2) Jaw with decided vertical ribs to its anterior surface.

ARION, Férussac.

Animal limaciform (see Vol. III. Pl. LXIV. Fig. 1). Posterior termination of body obtuse. Integuments crowded with elongated tuberosities on the back, and on the sides with elongated tubercular plates having furrows between. Mantle anterior, oval, small, covered with granulations, free at the front and on the sides, attached posteriorly, containing in its posterior part numerous fine calcareous sandy grains. Locomotive disk not expanded at the margin, when the animal is fully extended very narrow, having in some species a narrow median band, and in others not. Respiratory orifice at the anterior margin of the mantle, small. Anal orifice contiguous to the former. Orifice of organs of generation under the two last. On the upper part of the posterior extremity of the body is a triangular pore or sinus, with the point directed forwards, a process or projection of the integument serving as a cover to the sinus.

The genus is not indigenous to North America, the only known species here having been introduced by commerce.

The genus *Arion* was separated from *Limax* by Férussac, to contain those species of the latter genus having a terminal pore or sinus. It is universally recognized, and has been fortunate in escaping any confusion of synonymy.

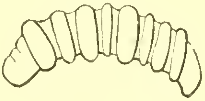
The habits of the North American species have been given on p. 11.

I have not been able to give any information regarding two of the species found within our limits, *A. Andersoni* (see below, p. 239), and *A. foliolatus*. Indeed there seems so much uncertainty in regard to them, that I doubt their belonging to this genus. For fuller information, see below. This leaves only one species, *A. hortensis*, Fér., described and figured in Vols. II. and III., and in L. & Fr.-W. Sh. N. A., I., referred to *A. fuscus*, Müll.

The species was introduced by commerce into Boston many years ago. It still exists there,[1] specimens having been found by me in 1871, from one of which I extracted the jaw and lingual membrane here described. I have compared the figures of the genitalia of *A. hortensis* given by Lehmann and A. Schmidt[2] with those given by Leidy in Terr. Moll. U. S. There is a difference in the position of the retractor muscle of the penis. Leidy places it at the base of the penis sac, Lehmann at the top, Schmidt omitting it entirely. The last two authors figure a retractor to the duct of the genital bladder, and so does Leidy (though in the description of the plates he refers it to the vagina). Lehmann figures a retractor also to the genital bladder itself. Lehmann's figure of the genitalia of *A. fuscus* (Pl. VI. Fig. 2) agrees more closely with Leidy's figure in all respects, indeed, but the position of the retractor penis, which Lehmann places at the top of the penis sac. His figure of the dentition of *fuscus* is nearer mine of the Boston specimens than is his of *hortensis*, though the transverse count of teeth is larger. Goldfuss's figure of the dentition of *A. hortensis* also (l. c. Pl. V. Fig. 6) differs from my figure in the same way, i. e. by the presence of an inner side cusp and cutting point to the lateral teeth. Thus I find it impossible to decide from the genitalia whether to refer our species to *fuscus* or *hortensis*, though I incline to the former. From the dentition I should assuredly adopt the former name also.

The jaw of the Boston specimen (Fig. 127) is thick, arcuate, ends but little attenuated; no median projection to the cutting edge; anterior surface with 8 stout, separated, unequal ribs, denticulating either margin.

Fig. 127.



Jaw of *A. fuscus*.

Lingual membrane (Pl. V. Fig. C) long and narrow. Teeth about 31—1—31, with about 10 perfect laterals. Centrals with the base of attachment longer than wide: reflection half as long as the base of attachment, bearing one long, stout cusp extending to the lower margin of the base of attachment, beyond which projects the stout cutting point; side cusps distinct, but small, with distinct, small, stout cutting points. Laterals like the centrals, but asymmetrical by the suppression of the inner, lower, lateral expansion of the base of attachment, and the inner side cusp and cutting point. The marginals are low, wide, with one long, bluntly pointed, oblique cutting point, bearing a subobsolete smaller point low down upon its outer side. This subobsolete side cutting point is on some of the marginals much more developed.

From the above remarks it will be seen that in this genus, as in *Limax*, *Zonites*, and others, the lateral teeth are either bicuspid or tricuspid. The number of cusps does not seem a generic character.

The internal calcareous grains which represent the shell are in some species isolated, in others aggregated into a nearer resemblance to the internal plate of *Limax*. On this distinction are based the subgenera *Lochea* and *Prolepis*.

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[1] Specimens can readily be found in gardens between Chestnut and Mt. Vernon Streets above Willow Street, as well as elsewhere.

[2] Der Geschlechtsapparat der Stylommatophoren, 1855.

SUBGENUS PROLEPIS, MOQ.-TAND.

Shield covering an imperfect, rugose, shell-like plate, formed by the aggregation of a certain number of calcareous granulations.

Arion fuscus, MÜLLER.

Vol. III. Pl. LXIV. Fig. 1.

Color whitish or light-ashy, sometimes with a tinge of brown, or dark grayish; an obscure, ill-defined dark-colored line or band rises where the mantle meets the base of the eye-peduncles on both sides, and, extending along the whole length of the mantle to its posterior extremity, converges towards the line of the opposite side; another band, proceeding from under the posterior edge of the mantle, not quite continuous with the above-described line, runs along the sides of the body to its extremity. Body cylindrical, narrow, when extended very much elongated, expanding a little towards its extremity, and ending in a flat and rounded termination; its upper surface is covered with narrow, oblong, prominent glands, appearing sometimes as if carinated, and arranged in parallel rows, the flanks with elongated tuberculated plates and finer granulations. Head darker than the body, projecting very little beyond the mantle. Eye-peduncles blackish, one eighth the length of the body, stout; bulbs translucent; ocular spot at the superior part, black. Tentacles immediately under the eye-peduncles, very short, conical. Mantle small, oval, narrow, commencing just behind the insertion of the eye-peduncles, less than one third of the length of animal; covered with granulations tending to a vermiform shape. Disk of the foot whitish, without a separate locomotive band, the marginal boundary between it and the body marked by a furrow, projecting beyond the body posteriorly. Respiratory foramen small, with a cleft to the margin of the mantle. Between the eye-peduncles is a tubercular ridge with furrows on each side. The triangular mucus pore is on the upper surface of the posterior extremity, is very apparent, and has a process of the skin which seems to cover it, and sometimes to project above it. When fully grown, the extreme length is more than 50 mill., the usual length about 25 mill. Internal granulations coarsely united or aggregated into a somewhat ovular, semi-transparent, very granular plate.

Limax fuscus, MÜLLER, Hist. Verm., II. 11 (1774).

Arion hortensis, FÉRUSSAC, Hist., 65, Pl. II. Figs. 4, 6; Suppl., p. 96, a (1819). — BINNEY, Bost. Journ. Nat. Hist., IV. 170 (1842); Terr. Moll., II. 27, Pl. LXIV. Fig. 1; LXV. Fig. 2 (1851). — LEIDY, T. M. U. S., I. 249, Pl. II. Figs. 1–4 (1851), anat. — DEKAY, N. Y. Moll., 23 (1843). — REEVE, Brit. L. & Fr.-W. Moll., 11, Fig.

Arion fuscus, MOQUIN-TANDON (which see for further foreign synonymes). — W. G. BINNEY, L. & Fr.-W. Sh., I. 275 (1869). — TRYON, Am. Journ. Conch., III. 316 (1868). — GOULD and BINNEY, Inv. of Mass., ed. 2, 451 (1870).

Found in the city of Boston. It is an introduced species common over the whole of Europe. Has also been introduced into Greenland (see Mörch, Am. Journ. Conch., IV. 37).

When the animal is fully extended, the mantle occupies less than a fourth part of its whole length, and the dark lines on the mantle and back are continuous with each other. The head only projects from the mantle, the neck not being visible. Its surface is constantly covered with a watery mucus, and it suspends itself with a thread of mucus like the other species. The mucous secretion from the terminal pore is transparent and very viscid. It is not distinguished by any considerable variety of color or markings. It occurs in small numbers in the city of Boston and vicinity under stones, at roadsides, in company with *Limax agrestis*, and more plentifully in gardens within the city. In the remarks on this species, formerly published by Dr. Binney, he hesitated in considering it to be identical with the foreign species of the same name. Having later found it somewhat numerous in a locality in Boston, he procured specimens agreeing very well with foreign descriptions and figures, especially with that variety described by Férussac as *griseus, unicolor, fasciis nigris*, and had no longer any doubt on the subject. The specimens found in gardens are, however, much larger than the size indicated by the descriptions. It is called a small species by both Férussac and Lamarck, and so it is, as it exists in the country; but in the city it is sometimes two inches in length, when not fully extended, and of a corresponding bulk. The dark lines are most strongly marked in the large variety. The small variety is more delicate in its markings, and has a tinge of yellow on the foot. It is still restricted in its distribution, so far as known, to the neighborhood of Boston alone.

For jaw and dentition see p. 223.

The generative system (figured by Leidy, l. c.) resembles more that of *Limax variegatus* than the other species. The penis sac is cylindrical, dilated at base, and has its retractor muscle inserted into the latter point. The genital bladder is large, oval, pointed at summit, and has a very short but muscular duct, joined midway by the vagina. At the latter junction is inserted a second retractor muscle. The cloaca is long and dilated in the middle.

SPURIOUS AND DOUBTFUL SPECIES OF ARION.

Arion (*Lochea*) *empiricorum* is quoted without authority or description from the Western States by GRATELOUP (Distr. Geogr. de la Famille des Limaciens).

Arion foliolatus, GOULD (Vol. III. Pl. LXVI. Fig. 2). Color a reddish-fawn, coarsely and obliquely reticulated with slate-colored lines forming areolæ, which are indented at the sides, when viewed by a magnifier, so as to resemble leaflets; the mantle is concentrically mottled with slate-color, and the projecting border of the foot is also obliquely lineated. The body is rather depressed, nearly uniform throughout, and somewhat truncated at the tip, exhibiting a conspicuous pit, which was probably occupied by a mucus gland. The mantle is very long, smooth, and has the respiratory orifice very small, situated a little in front of the middle. The eye-peduncles are small and short. Length, 85 mill.

Arion foliolatus, GOULD, Moll. U. S. Exped., 2, Fig. 2, *a*, *b* (1852). — BINNEY, Terr. Moll., II. 30, Pl. LXVI. Fig. 2 (1851). — W. G. BINNEY, Terr. Moll., IV. 6; copied also by TRYON and W. G. BINNEY, L. & Fr.-W. Sh., I. 377.

Jaw — ?

Lingual membrane — ?

Found at Discovery Harbor, Puget Sound.[1]

This species is still unknown otherwise than by the original description and figure.

Arion Andersoni (see p. 235, footnote, and 236, 239).

ARIOLIMAX, MÖRCH.[2]

Animal limaciform (Vol. III. Pl. LXVI. Fig. 1), blunt in front, pointed behind. Mantle anterior, small, bluntly truncated before and behind, free around its edges, containing a well-defined, solid, testaceous plate. A longitudinal furrow along the sides above the foot. A distinct locomotive disk. Respiratory orifice at the posterior third of the mantle, with a cleft to its right margin. Anal orifice contiguous to the last, slightly below and behind it. Orifices of generation on the right of the body, below the anterior, free part of the mantle, distinct but contiguous (in *A. Californicus*, certainly), that of the male organ anterior. Tail furnished with a perpendicular, triangular mucus pore, with a horizontal mucus slit to the end of the tail.

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[1] It is erroneously quoted from Boston, by Grateloup, Distr. Geog. des Limaciens, p. 8.

[2] Animal limaciforme, postice acuminatum. Pallium antice situm, parvum, obtusum, marginibus liberis, testam simplicem haud spiralem, solidam includens. Margo infera animalis sulco longitudinali supra pedem posito munita. Discus gressorius distinctus. Apertura respiratoria ad marginem dextram pallii in parte posteriore posita; apertura analis vicina, sed postice et infra posita. Apertura genitalis ad latus dextrum corporis, sub parte anteriore libera pallii posita (in *A. Californico* duobus orificiis distinctis munita). Porus mucosus caudalis triangularis erectus supra apicem pedis.

Maxilla leviter arcuata, costis numerosis (VIII – XX), validis, confertis munita; marginibus denticulatis.

Lamina lingualis ut in Helice constituta. Dentes medianæ tricuspidatæ; laterales bicuspidatæ; marginales quadratæ, irregulariter cuspidatæ, cuspide interna producta, externa sæpissime subobsoleta.

Habitat in regionibus Pacificis Statuorum Unitorum, inter Oceanum et montes "Cascade" et "Sierra Nevada" dictas, de lat. 34° usque ad 49°.

Genus a cl. Mörch primo descriptum, Mal. Blätt., VI. 110, Oct., 1859; postquam a W. G. Binney, Amer. Journ. Conch., I. 48, Pl. VI. Fig. 11 – 13, 1865; deinde, W. G. Binney et T. Bland, L. & Fr.-W. Sh. N. A., I. 278, Fig. 496 – 498, 1869. Ceteris auctoribus ad *Limacem* refertur: Gould in Terr. Moll. U. S., II. 1851; W. G. Binney ante, Ter. Moll., IV. 1859; Tryon, Am. Journ. Conch., III. 315, 1868.

Genus *Limaci*, *Arioni* et *Prophysaonti* affine, sed facile distinguendum. *Limaci* affine est testa interna, positione aperturæ respiratoriæ, et disco gressorio distincto; sed differt poro mucoso caudali, maxilla costata, dentibus marginalibus quadratis laminæ lingualis, et positione aperturæ genitalis. *Arioni* simile poro mucoso caudali, disco gressorio distincto, maxilla costata, lamina linguali, positione aperturæ genitalis; sed differt positione aperturæ respiratoriæ, et testa interna. *Prophysaonti* simile testa interna, maxilla costata, lamina linguali; sed differt positione aperturarum, respiratoriæ et genitalis, disco gressorio distincto, et poro mucoso caudali.

Ab ceteris generibus Americanis limaciformibus aut sublimaciformibus, *Veronicella*, *Binneia*, *Hemphillia*, *Tebennophoro* et *Pallifera* sat distinctum est.

Testaceous plate flat, thick, calcareous, simple, not spiral; longer than wide, hexagonal.

Inhabits the Pacific Province, on the Pacific Coast of the United States, at least from latitude 34° to 49°, apparently not eastward of the Sierra Nevada and Cascade Ranges.

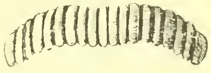
The species on which the genus was founded has been known for many years as a *Limax* (see Gould in Terr. Moll. U. S., II., III. and Ex. Ex. Mollusca, where an additional figure is given), but it was not until 1859 that Mörch (Mal. Blätt. VI. 110) recognized it to be distinct from *Limax* and proposed a generic name, *Ariolimax*. In 1865, W. G. Binney (Amer. Journ. Conch., I. p. 48, Pl. VI. Figs. 11 – 13) gave a more detailed generic description, adding figures of jaw and lingual dentition. These were also given in Land and Fresh-Water Shells N. A., I. p. 278, Figs. 496 – 498 (1869). As late as 1868 the species is still retained in *Limax* by Tryon (Amer. Journ. Conch. III. 315), who gives a copy of one of Gould's figures from the Terrestrial Mollusks.

The genus has affinities with, but is readily distinguished from *Limax*, *Arion*, and *Prophysaon*. It agrees with *Limax* in having an internal shelly plate, in the position of its respiratory orifice and its distinct locomotive disk; but it differs in having a caudal mucus pore, a ribbed jaw, quadrate (not aculeate) marginal teeth on the lingual membrane, and in the position of its genital orifice. With *Arion* it agrees in having a mucus pore, a distinct locomotive disk, a ribbed jaw, in its lingual membrane, and position of the genital orifice; but it differs in the position of its respiratory orifice and its internal shell. With *Prophysaon* it agrees in having an internal shell, a ribbed jaw, in its lingual membrane; but differs in the position of the genital and respiratory orifices, in its distinct locomotive disk and caudal mucus pore.

From the other sluglike, or semi-sluglike American genera, *Tebennophorus*, *Pallifera*, *Binneya*, *Hemphillia*, *Veronicella*, it is most readily distinguished.

Jaw thick, slightly arcuate, ends but little attenuated, blunt; low, wide; anterior surface with numerous stout ribs, denticulating either margin. The number of ribs varies in the several species, and in different individuals of the same species. Fig. 128, drawn from the true northern *A. Columbianus*, has 18 ribs; another specimen, supposed to be the same species, has about 12. (See Proc. Acad. Nat. Sci. Phila., 1874, Pl. II. Fig. 11.) *A. Californicus* has given 13 and 14 ribs. *A. niger* has been described by Dr. Cooper with 20, but I found only 8 in one specimen which I refer to that species. In *A. Hemphilli* there are from 8 to 12; in *H. Andersoni?* there are 13 ribs.

Fig 128.



Jaw of *Ariolimax Columbianus.*

Fig. 498 of p. 279, Land and Fresh-Water Shells N. A., I., gives the general arrangement of the teeth upon the lingual membrane. It is drawn from the true northern *A. Columbianus.* Its general arrangement is as in *Patula.* On Pl. V. Fig. E, I have given more detailed figures of the dentition of a specimen of this species. It will be seen that the central teeth have a base of attachment longer than wide, with expanded lower angles and incurved lower margin; the upper margin is reflected; the reflection is large, broad, and has a short, stout median cusp, bearing a long, stout cutting point; the side cusps of the reflection are subobsolete, but there are well-developed triangular cutting points. The laterals are like the centrals, but asymmetrical by the suppression of the inner lower lateral expansion to the base of attachment, and the inner side cutting point, the inner side cusps being still subobsolete. The change from lateral to marginal teeth is shown in *b* and *c*, the inner cusps and cutting point being greatly developed, and the base of attachment is still narrower than in the first laterals. The marginals are shown in *d* and *e*. They are about as high as wide, the reflection equals the base of attachment and bears an extremely long, blunt, stout, oblique cutting point, with a side spur upon the last, in the extreme marginals developed into a short, stout, side cutting point. The cutting point of the marginals by its great development forms the chief characteristic of the membrane; it is well shown in profile.[1] There were 22 perfect laterals in this specimen. The figure referred to above shows only 12 laterals, with 113 rows of 56—1—56 teeth each.

I have examined one specimen of *Ariolimax niger*, J. G. Cooper, preserved in spirit, belonging to the State collection of California, labelled and presented by Dr. Cooper, and in all respects an authentic type. Agreeing with this type I have other specimens from various Californian localities, so that I believe the species to be well established and generally distributed along the coast of California.

From the Museum of Comparative Zoölogy at Cambridge, Mr. Anthony has sent me a specimen, long preserved in alcohol, marked from San Mateo, California. For reasons given below, I am inclined to consider this the form described by Dr. Cooper as *A. Californicus.* I have had the opportunity of examining another specimen of this form, received from Mr. Stearns, who collected it near San Francisco. And recently I have examined specimens received from Dr. Cooper.

From Mr. Henry Hemphill I have received a specimen from San Mateo County, California, which presents most decided specific differences from the last-mentioned form, especially in its genitalia. Having considered the last-mentioned form as *A. Californicus*, I was forced to consider this as *A. Columbianus*, the only remaining described species. I had not at that time compared it with specimens from more northern regions, whence the species was originally described, but I have now verified the identity of this form, having received it from the original locality.

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[1] In only one instance have I seen marginal teeth as in my figure (of Pl. V. Fig. F, *d*). In all other specimens examined the marginals are as figured in Pl. V. Fig. E, *e*, with one long cusp and one obsolete side cusp.

In treating these various forms,[1] I have abstained from giving any description of their exterior markings. Such description would be unreliable, as the specimens have been long preserved in alcohol,[2] and are evidently in various degrees of contraction. I will say, however, that I found in all the blind sac under the mouth (well marked, though not very deep), which is suspected by Dr. Leidy to be the seat of the olfactory nerve.

I can also here refer to several external characters not affected or obliterated by contraction in alcohol. All the specimens have a distinct locomotive disk to the foot. In all, the orifice of respiration is decidedly posterior to the middle of the right margin of the mantle. The position of the anus I found in *A. Columbianus* to be posterior and inferior to the respiratory orifice, with a gutter-like groove to the edge of the mantle. The position of the orifice of the generative organs is not so easily decided in alcoholic specimens. I have no doubt, however, that in the living animal it is under the mantle, not close behind the right tentacle. In one form, *Ariolimax Californicus*, there are beyond doubt two distinct orifices; that of the male being smaller and anterior. In Dr. Cooper's figure of *A. Californicus* (Proc. Phila. Acad. Nat. Sci., 1873, Pl. III. Fig. D, 3) the two orifices are plainly shown, and suggested to me the identity of my specimens with his species, especially as the external markings also agreed with his description. In *A. Columbianus* also there is no common duct or cloaca, as Dr. Leidy calls it, to the genitalia, though I could not detect more than one exterior orifice. In *A. niger* there can be but one common orifice, judging from the penis entering into the common cloaca, as shown in Fig. F of Pl. XII. The same may be said of *A. Hemphilli* and *A. Andersoni?*

The mantle is free on its margin in its whole circumference, especially in front and on its sides as far back as the respiratory orifice. I could detect no concentric lines or other markings on the mantle. The mantle was greatly produced and swollen on its margins in Mr. Stearn's specimen of *A. Californicus.* In that and all the specimens examined I found an internal shell, varying somewhat in thickness, but always well marked, calcareous, sub-hexagonal, longer than wide. In the specimen of *A. Columbianus* there were decided concentric lines of growth on the shell, as will be seen below in my figures, also in *Andersoni* and *Hemphilli.*

The caudal mucus pore was plainly visible in all the specimens of *A. niger* which I have examined. In Fig. 133 I have figured the pore of this species. It seems to be in two portions, one erect, triangular, at the end of the body of the animal, with another running at right angles with it in a gutter-like excavation towards the extreme end of the tail. In *A. Columbianus* and *A. Andersoni* the pore was quite different from this, as seen in Fig. 130. In this the erect portion of the pore is entirely wanting, the carinated body being arched regularly down to, and overhanging the foot. The longitudinal gutter-like pore is, however, plainly visible. In numerous specimens of *A. Californicus*, the body is also arched down to, and overhangs the foot. On the tail, corresponding to the gutter-like pore of the last-mentioned form, there was no sign of any pore, but in its place the flesh was sponge-like, without the markings which are found on the neighboring portions of the foot. It may be, therefore, that in these specimens the mucus pore was contracted or closed. No doubt it exists in the living animal, and lately I have had the opportunity of seeing it there.

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[1] I have also examined *A. Hemphilli* and *A. Andersoni?* Thus I have had opportunities of examining authentic specimens of all our species.

[2] Since the above was written, I have received all the species alive.

Of the internal anatomy I have examined the nervous system in both *A. Californicus* and *A. Columbianus*. The ganglia present the usual three sets, all globular in form, and so crowded together in the subœsophageal and superœsophageal as almost to form a continuous chain around the buccal mass.

In these same two forms, also, I have examined the circulatory and respiratory organs. Within the respiratory cavity is a large, spongy, ear-shaped organ, attached only at one point to the roof of the chamber. This I suppose to be the renal organ, surrounding, and indeed enclosing, the heart, though it is not so arranged in any of the genera described by Dr. Leidy. In *Arion hortensis* he describes the nearest approach to such an arrangement.

I have examined the digestive system of all the forms, and figured (l. c.) that of both *A. Californicus* and *Columbianus*. In the latter (Pl. II. Fig. D, F, referred to) the buccal mass (1) is large and round, the salivary glands (4) short and broad; the stomach (5) long and large, with a decided constriction at its middle, and the usual cul-de-sac (6) at its extremity, at which point the biliary ducts (7, 7) enter; from this the stomach passes into the intestine (8), which proceeds first forward almost to the œsophagus, thence proceeds backward to the extreme rear of the general cavity of the body, and again forward to below the respiratory cavity, into which it penetrates upwards as the rectum (9), and through which it passes to the anus, whose position is described above. The intestine in its whole course winds among, and is imbedded in, the various lobes of the liver, which latter organ is arranged as usual in *Limax*, *Arion*, etc.

In *A. Californicus* (Pl. XI. Fig. E, l. c.) there is a difference in the arrangement of the stomach. Before reaching the cul-de-sac (6), the stomach is greatly constricted, and the cul-de-sac runs at right angles with the stomach in an erect position, not lying on its side as I have represented it, in order to show the connection between it and the anterior portion of the stomach, which connection was entirely concealed by the cul-de-sac in its upright position.

The extreme length of the digestive system is three times that of the whole body of the animal, at least in its contracted state.

The jaw in all the forms of *Ariolimax* is quite thick, dark horn-colored, arcuate; ends but little attenuated, blunt; anterior surface with stout ribs, denticulating either margin. I have figured (l. c.) the jaw of *A. Columbianus*, which has about 12 ribs (on p. 227 another specimen with 18). In *A. Californicus*, from Mr. Anthony, there were 13 ribs to the jaw; 14 in Mr. Hemphill's specimen of the same. In *A. niger* Dr. Cooper describes about 20, but in one specimen I found but 8. In *A. Hemphilli*, I found 8 – 12 ribs; in *A. Andersoni*, 13 ribs.

The pouch of the lingual membrane is shown in Pl. II. Fig. D, 5 (l. c.) The membrane is as usual in the *Helicidæ*, with tricuspid central, bicuspid lateral, and quadrate marginal teeth, showing simply a modification of the laterals. In Land and Fresh-Water Shells, I. p. 280, I have figured the lingual membrane of the true northern *A. Columbianus*, which has the general arrangement of *Patula*. See also Pl. V. Fig. E. The marginal teeth are shown to have one long denticle and a small, subobsolete side denticle. This form of marginal teeth I have found also in one of Dr. Cooper's types of *A. niger* (Pl. V. Fig. D), and in *A. Californicus* (Pl. V. Fig. F), also in *A. Andersoni ?* (Fig. G) and *A. Hemphilli* (Fig. H). This form of marginal tooth may therefore be considered characteristic of the genus; though in one specimen, supposed to be *A. niger*, I noticed marginal teeth with the outer cusp much more developed and bifid, and figure them in Fig. D, *f*, of Pl. V. The gradual change from the first lateral tooth to the last marginal tooth is well shown in Fig. H of Pl. V., which represents the teeth of *A. Hemphilli*.

There is no retractor muscle to the buccal mass in *A. Californicus* and *A. Columbianus*, but a very stout, broad one to the whole head, attached to the outer integument below the buccal mass, and running along some distance on the floor of the general visceral cavity, to which finally it becomes attached.

Ariolimax Columbianus, GOULD.

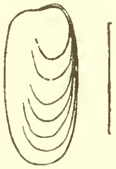
Vol. III. Pl. LXVI. Fig. 1.

Color a dark, dirty, greenish-yellow, either uniform or in some varieties clouded with large purplish-black, irregular blotches. The body is large and corpulent, the anterior portion elevated, with the back rounded, and the posterior portion strongly carinated; at the posterior tip there is a mucus pore. The margin of the foot extends beyond the mantle and forms a ruffle around the animal, with transversely oblique markings. The surface is tessellated with coarse elongated papillæ arranged longitudinally. The mantle is broad, truncated in front, minutely granulated, with the respiratory orifice at the posterior third. Face vertically wrinkled; eye-peduncles rather short, thickened at base, colored like the body and finely granulated; tentacles long and slender. Length, 5½ inches.

Limax Columbianus, Gould in Teit. Moll., II. 43, Pl. LXVI. Fig. 1 (1851); U. S. Expl. Exped. Moll., 3, Fig. 1, *a*, *b* (1852). — Tryon, Am. Journ. Conch., III. 315 (1868).

Ariolimax Columbianus, Mörch, Mal. Blätt., VI. 110. — W. G. Binney, Am. Journ. Conch., I. 48, Pl. VI. Figs. 11 - 13; L. & Fr.-W. Sh., I. p. 279, Fig. 499 (1869).

Fig. 129.



Internal plate of *A. Columbianus*.

Internal shell longer than broad, hexagonal, ends pointed.

Specimens referred to this species have been found in Washington Territory, Oregon, and California (Straits of Fuca to Santa Barbara, *Cooper*). It therefore inhabits the Pacific Region.

In form, marking, and coloring it may be compared to *Arion empiricorum* of Europe.

Dr. Cooper remarks: —

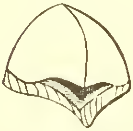
"This large slug abounds in the dense damp forests near the Pacific Coast, and was not observed by me in the dry region east of the Cascade Mountains. It is to be found every month of the year in Washington Territory, being even more abundant in the rainy winter than in warmer seasons; its activity being checked only by extreme cold, while it cannot bear continued drought. It not unfrequently drops from the trees, etc. This slug grows to the length of six inches, but shrinks to a third of that size in alcohol. Its surface is smooth, not rugose, when alive, as represented in Dr. Binney's plate, and its color is a pale yellowish-olive, usually more or less blotched with black." (Pac. R. R. Rep. p. 377.)

Jaw narrow, arcuate, dark horn or reddish; anterior surface with more than 15 coarse, crowded ribs, denticulating the concave margin (Fig. 128).

Lingual membrane (see p. 231).

On Pl. XII. Fig. C, I have figured the genitalia of *A. Columbianus*, which has a very large ovary against which the testicle lies, as in the following species. The ovary is so large as to take up one half of the entire visceral cavity, extending completely across the body, resting on the floor of the cavity, its ends recurved upwards so as to rest upon the liver on the upper surface of the viscera. The body of the animal externally is swollen by the large size of the ovary. The oviduct is narrow, long, greatly convoluted, ending in an extremely long, convoluted vagina. The genital bladder is oval, large, with a short, stout duct. The vas deferens, unlike that of the following form, is as usual in the land shells. It enters the penis at its summit, opposite the retractor muscle. The sac of the penis is very stout, long, cylindrical. The external orifice is described above.

Fig. 130.



Caudal pore of *A. Columbianus*.

The caudal mucus pore described on p. 230 is here figured.

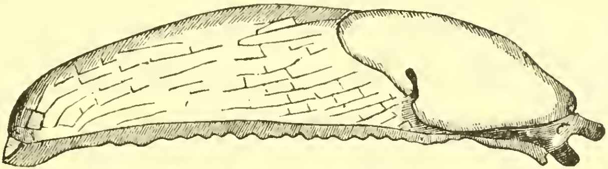
Ariolimax Californicus, J. G. Cooper.

External characters resembling very nearly those of *A. Columbianus*, but differing in the genitalia.

Ariolimax Californicus, J. G. Cooper, Proc. Acad. Nat. Sc. of Phila., 1872, 146, Pl. III. Fig. D, 1-3.

In the California Province, around San Francisco, and in the Sierra Nevada (latitude 39°) of the elevation of 3,500 feet.

Fig. 131.



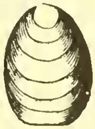
A. Californicus, contracted in spirits.

Jaw (see p. 227).

The lingual membrane (Pl. V. Fig. F) has the same type of dentition as in *A. Columbianus*, but the bases of attachment are more developed, and are produced beyond the reflection at their upper margin. There are 80—1—80 teeth, with 9 perfect laterals.

The genital system of *A. Californicus* is figured in D of Pl. XII. The testicle does not lie far away, imbedded in, or resting on, the upper lobes of the liver, but lies close against the ovary, in the semicircle formed by the recurving of the apex of the ovary upon itself. In this respect, the position of the testicle is different from that of most slugs, and affords an excellent specific character. The testicle is kidney-shaped, as it is covered by its investing membrane. It appears to consist of closely bound fasciculi of short, white, tubular, not aciniform cæca. The epididymis is short, and still more shortened by its excessive convolution. The accessory gland is partially imbedded in the ovary. The ovary is large and distinctly lobulated. The oviduct is narrow, very long, greatly convoluted. The genital bladder is oval, large, with a short, stout duct. The penis is enclosed in a long tapering sac, terminating in a decided flagellum, in which I detected no capreolus. On the end of the flagellum is a large, globular bulb. The retractor muscle of the penis is attached to the roof of the general visceral cavity, below the pulmonary chamber. It joins the penis at the commencement of the flagellum. The vas deferens is peculiar. It leaves the prostate gland as usual, runs alongside of the vagina to the base of the penis, thence runs upwards, swelling to an enormous extent, so as to equal the breadth of the penis, then again becomes gradually reduced to its former size, until, as the most delicate thread, it enters the penis at the end of the flagellum below the bulb. The penis sac did not appear in the animal extended as drawn in the plate, but was twice recurved upon itself. There is also a vaginal prostate, large, ear-shaped, close to the exterior orifice of the female organs, which, with that of the male, is described above (p. 229).

Fig. 132.



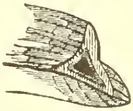
Internal plate of *A. Californicus*.

For other anatomical details, see p. 229 *et seq*. The internal shelly plate there described is here figured.

Ariolimax niger, J. G. Cooper.

Body long and narrow, blunt before, but little attenuated, and bluntly truncated behind, with the termination of the body not arched down to the tail as in *Columbianus* and *Californicus*, but rather erect, giving the appearance of being cleft, and showing much more plainly the caudal gland. Mantle quite small, bluntly rounded before and behind. Color leaden below, blackish above. Length contracted in spirits about 30 mill. Dr. Cooper gives 2½ inches as the length of the living animal.

Fig. 133.



Caudal pore of *A. niger*.

Ariolimax niger, J. G. Cooper, Proc. Phila. Acad. Nat. Sci., 1872, 147, Pl. III. Fig. B, 1-4.

Found in the California Region. I have received specimens from Oakland, Bolinas, Santa Rosa, Healdsburg, Sonoma County. They all agree in their genitalia, as well as in outward form.

This species preserved in alcohol is most readily distinguished by its smaller size, dark color, subcylindrical body, and especially by its bluntly truncated posterior termination, which is decidedly cleft at the mucus pore. The nature of the pore is described above (p. 229).

Jaw (see p. 227).

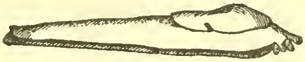
Ariolimax niger, also (Pl. V. Fig. D), has the same type of dentition as *A. Columbianus;* the side cusps of the centrals are, however, more developed. On one specimen I found marginal teeth with one inner stout, short, rounded cutting point, and two shorter, rounded, side cutting points (see Fig. F), instead of the usual long cutting point. This is the only variation in the dentition of the genus which I have noticed. There are about 48—1—48 teeth.

On opening the body of *A. niger* (Pl. XII. Fig. F), the genitalia are found in the usual place, the testicle lying quite at the rear of the visceral cavity near the extreme point of the upper lobes of the liver, hardly imbedded in it, connected with the ovary by a long epididymis. The testicle is globular in form, composed of black, aciniform cæca. It contrasts in color with the dirty white of the liver. Color, however, I have not found constant in the internal organs of land shells preserved in spirits. The above-described arrangement of the testicle is as usual in *Limax*, *Arion*, and other slugs. It forms an excellent specific character for *A. niger*, the position of the testicle being quite different in *A. Californicus* and *A. Columbianus*, as will be seen above. The epididymis is long, convoluted at the end nearer the ovary. The accessory gland is small. The ovary is large, yellowish. The oviduct and prostate show no unusual characters. The genital bladder is large, oval, with a short duct. The penis is in a short, stout sac, which has a bulb-like swelling at its upper extremity, where the vas deferens enters. The latter organ has nothing of peculiar interest. A vaginal prostate, or perhaps dart sac, is shown in *p*, *g*. The external orifice is described above.

Ariolimax Hemphilli.

From 25 to 31 mill. long, of a transparent flesh-color, much more slender than the other known species, with a much more pointed tail. The mantle is also longer. These characters, even in specimens preserved in alcohol, readily distinguish the species. On dissecting the specimens, I also found distinguishing specific characters in the genitalia (Pl. XII. Fig. G). The testicle, imbedded in the liver, is brown, composed of thickly packed fasciculi of long, blunt cæca; the mass formed by them is cuneiform. The ovary is narrow and pointed. The genital bladder is small, oval, with a short, narrow duct, which becomes much more swollen at its junction with the vagina. The penis sac is extremely short, globular, receiving the vas deferens at its upper posterior portion, and the retractor muscle at its farther end. Opposite the mouth of the penis sac the vagina is greatly swollen.

Fig. 134.



A. Hemphilli, contracted in spirits.

Ariolimax Hemphilli, W. G. Binney, Ann. Lyc. of Nat. Hist. of N. Y., XI. 181, Pl. XII. Fig. 7 (1875).

A comparison with my figures of the genitalia of *A. Andersoni*, *Columbianus*, *Californicus*, and *niger* will show how widely they differ from those of the present species.

The jaw is thick, low, wide, slightly arcuate, ends scarcely attenuated; anterior surface with 8 – 12 decided ribs, denticulating either margin.

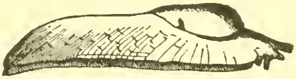
Lingual membrane (Pl. V. Fig. H) as usual in the genus. Teeth, 31—1—31.

A species of the Californian Province, found at Niles Station, Alameda County, California.

Ariolimax Andersoni, J. G. Cooper.

From Mr. L. G. Yates I have received specimens of an *Ariolimax* found in the mountains of Alameda County, California. From the fact of the reticulations of the surface of the animal having the foliated appearance noticed in *Arion foliolatus*, Gld., *Prophysaon Hemphilli*, Bl. & Binn., and *Arion Andersoni*, J. G. C., I am inclined to refer the specimens to one of those species. I am entirely unacquainted with the first (see Ann. N. Y. Lyc. N. H., X. 297), the second is generally distinct, the latter may be identical.[1] The specimens have all the characters of *Ariolimax*. They are about 35 mill. long.

Fig. 135.



A. Andersoni, contracted in spirits.

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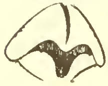
[1] I have lately received from Dr. Cooper, under the name of *Arion Andersoni*, specimens agreeing perfectly with the form of *Prophysaon* referred to as probably undescribed on p. 296, and Pl. XIII. Fig. 5, of Ann. of Lyc. of N. H. of N. Y., Vol. X. Should Dr. Cooper's *Arion Andersoni* prove, therefore, to be a *Prophysaon*, it will retain its specific name, while the slug before us may also retain the specific name *Andersoni*. See p. 239.

The jaw is as usual in the genus, wide, low, with about thirteen broad, separated ribs, denticulating either margin. The lingual membrane is as usual. Teeth, 48—1—48. The characters of the teeth are sufficiently shown in my Fig. G, of Pl. V. The change from laterals to marginals is very gradual, the latter being but a simple modification of the former.

The genitalia (Pl. XII. Fig. E) are very much like those of *A. niger*, especially in the shape of the penis sac, and the peculiar accessory organ (*p, g*), probably a vaginal prostate. The genital bladder differs somewhat in shape, and also the testicle.

Fig. 136.



Caudal pore of *A. Andersoni.*

The rudimentary shell has decided concentric layers. The caudal mucus pore is as in *A. Columbianus.*

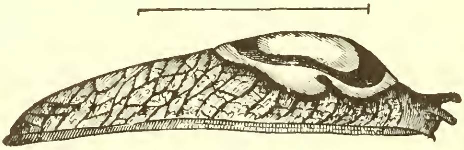
Ariolimax Andersoni? see W. G. Binney, Ann. Lyc. Nat. Hist. of N. Y., XI. 182, Pl. XII. Fig. 9 (1875).

Should this not prove the species described as *Arion Andersoni* by Dr. J. G. Cooper, it must receive a new name. It is a true *Ariolimax*, most nearly related to *A. niger.* The latter species wants the foliated reticulations, and has its posterior termination more blunt, with a decided lateral cleft at the mucus pore.

PROPHYSAON.[1]

Animal limaciform, attenuated behind. Mantle anterior, small, obtuse before and behind, its margins free as far back as the cleft for the respiratory orifice, enclosing a simple, not spiral, subhexagonal shell, which is longer than wide. A longitudinal line around the animal just above the edge of foot. No

Fig. 137.



Prophysaon Hemphilli.

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[1] Animal limaciforme, postice acuminatum. Pallium antice positum, parvum, obtusum, marginibus anterioribus liberis, testam simplicem, haud spiralem includens. Margo infera animalis sulco longitudinali supra pedem posito instructa. Discus distinctus gressorius nullus. Apertura respiratoria et analis ad marginem dextram pallii paululum anteriorem positæ. Apertura genitalis ad latus dextrum, pone et infra tentaculum oculigerum. Porus mucosus caudalis nullus.,

Testa interna longa, subhexagonalis.

Maxilla leviter arcuata, costis numerosis validis (in specie unica circa XV), confertis munita; marginibus denticulatis.

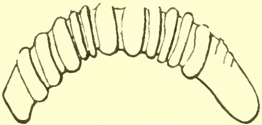
Lamina lingualis ut in Helice constituta. Dentes medianæ tricuspidatæ, laterales bicuspidatæ, marginales quadratæ, irregulariter cuspidatæ.

Habitat in Oregon et in California. Specimina plurima collegit H. Hemphill de Astoria usque ad San Francisco.

distinct locomotive disk to foot, but crowded, oblique furrows running from centre to edge. Respiratory and anal orifices on the right margin of mantle, slightly in advance of its centre, with the usual cleft to the edge. Genital orifice behind and below, but quite near to the right eye-peduncle. No caudal mucus pore.

Jaw of the single species known, *P. Hemphilli*, thick, low, wide, slightly arcuate, with but little attenuated ends, cutting margin without median projection; anterior surface with 15 stout, irregularly developed, separated ribs, denticulating either margin (see Fig. 138).

Fig. 138.



Jaw of *P. Hemphilli*.

Lingual membrane (Pl. V. Fig. I) long and narrow. Teeth about 40—1—40, with 16 perfect laterals. Centrals with a base of attachment longer than wide, reflection extending less than one half the length of the base, with a very stout, short median cusp, bearing a stout, short, blunt cutting point, and on either side a subobsolete cusp bearing a stout, bluntly rounded, short cutting point. Laterals like the centrals, but asymmetrical, as usual, by the suppression of the inner side cutting point and inner lower, lateral expansion of the base of attachment. Marginals (*b*) low, wide, with one inner, stout, oblique cutting point and two outer, smaller, blunt cutting points.

As in all lingual membranes, there is a difference in the development of the cusps and cutting points on various parts. The teeth figured are the least graceful in their outlines.

Found in the Pacific Province, in Oregon and California. Mr. Henry Hemphill has collected specimens from Astoria to San Francisco Bay.

This genus agrees with *Limax* by having an internal shell, and by the position of the genital orifice. It differs by its ribbed jaw, by the subquadrate marginal teeth of the lingual membrane, and by the anterior position of its respiratory orifice. The genus is allied to *Arion* by its ribbed jaw, its quadrate marginal teeth of the lingual membrane, and by the anterior position of its

Genus *Limaci*, *Arioni* et *Ariolimaci* affine, sed facile distinguendum. *Limaci* affine est testa interna, et positione aperturæ genitalis; sed differt maxilla costata, dentibus lingualibus marginalibus subquadratis, et positione aperturæ respirationis. *Arioni* simile est genus maxilla costata, dentibus lingualibus marginalibus et positione aperturæ respiratoriæ; sed differt testa interna, positione aperturæ genitalis, et poro mucoso carente. *Ariolimaci* affine est maxilla costata, dentibus marginalibus quadratis lingualibus, et testa interna; sed differt positione aperturarum, respiratoriæ et genitalis, et poro mucoso carente. De omnibus generibus supra comparatis differt etiam nostrum genus carente disco gressorio distincto.

De genere Hibernico *Geomalaco* differt carentibus poro mucoso caudali, disco distincto gressorio, et positione pallii et aperturæ respiratoriæ (in *Geomalaco* valde anteriore); affine est testa interna, dentibus quadratis marginalibus lingualibus, maxilla.

Ab ceteris generibus Americanis sat distinctum est.

respiratory orifice; it differs in having an internal shell, in the position of its generative orifice, and by the want of a caudal mucus pore. The genus is also allied to *Ariolimax* in having a ribbed jaw, quadrate marginal teeth to its lingual membrane, and an internal shell; it differs in the position of both genital and respiratory orifices, and by the want of a caudal mucus pore. The absence of a distinct locomotive disk to the foot distinguishes our genus also from *Arion, Limax,* and *Ariolimax.* It is not readily confounded with any other known American genus. The Irish genus *Geomalacus* is somewhat allied, having an anterior respiratory orifice and an internal shell, and quadrate marginal teeth. *Geomalacus,* however, differs from *Prophysaon* in having an extremely anterior mantle and orifice of respiration close behind the right tentacle. It also has a locomotive disk and caudal mucus pore.

Prophysaon Hemphilli.

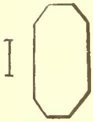
Body blunt anteriorly, attenuated posteriorly, rounded and high on the back. Mantle granulated, whitish with a circular ring of smoke-color above the respiratory orifice. Body obliquely reticulated with bluish lines, the reticulations larger (about twelve) below each side of the mantle, more numerous and smaller on the posterior extremity of the body. These reticulations are subdivided by irregularly disposed, rounded tuberosities, with colorless interstices. Above the foot, from the longitudinal line running around the animal to the edge of the foot, are perpendicular lines or furrows, also bluish in color. The foot has crowded wrinkles, running obliquely backwards from its centre to its margins. Length of an alcoholic specimen, 40 mill. (See Fig. 137.)

Prophysaon Hemphilli, Bland and W. G. Binney, Ann. Lyc. Nat. Hist. of N. Y., X. 293, Pl. XIII. Fig. 8 (1873).

Forest Grove and Astoria, Oregon; the variety at Oakland and Mendocino County, California; thus it is found in the Pacific Province.

The internal shell (Fig. 139) differs in thickness, but is always well marked, sometimes suboval, sometimes subhexagonal, always longer than wide.

Fig. 139.



Internal plate of *P. Hemphilli.*

The jaw and lingual membrane (Pl. V. Fig. I) have been described above.

The genitalia are figured on Pl. XII. Fig. II. The testicle is composed of black aciniform cæca; it is almost completely buried in the upper lobes of the liver, the epididymis completely so, lying on the floor of the cavity formed by the spiral winding of the upper lobes. It appears to pass through one of the lower lobes to join the oviduct, before reaching which it is greatly convoluted. The accessory gland of the epididymis appears to be composed of several aciniform cæca of unequal size. The prostate gland is large. The vas deferens is extremely long, ten times as long as the penis, and equals the length of the whole genital system. It is attached to the side of the vagina quite to the penis sac, where it becomes free, and is spirally wound. It is largest about half-way from the vagina to the apex of the penis sac. It enters the penis sac at the centre of its truncated apex. The penis sac is very short and stout, cylindrical, of equal breadth throughout. It has no retractor muscle. The cloaca is very short. On the vagina, just above the penis sac, appears on some specimens an extremely small, sac-like organ, not figured in the plate, as I am not entirely satisfied as to its presence. It is perhaps a dart sac, or a prostate. The ovary has the usual tongue-shaped form. The oviduct is not much convoluted. The vagina is long, and extremely broad, several times convoluted. The genital bladder is oval, small, with a short, stout duct entering the vagina at its upper extremity, bv the side of the terminus of the oviduct.

This peculiarly stout, cylindrical penis sac and broad vagina were constant in eight specimens examined, all from Astoria. In several other specimens from Mendocino County, easily detected exteriorly by a more slender, tapering body, and smaller, more rounded mantle, the penis sac was found more elongated, the vagina less broad, the genital bladder larger, with a more delicate duct. In these specimens, also, the testicle was very much larger, and was not concealed in the liver, but only slightly entangled in it at one point, against which it lay. The epididymis in these specimens was also free from the liver. The genitalia of this form differ enough from those of the Astoria specimens to warrant our belief in the existence of a second species of *Prophysaon.* We have, therefore figured, also (Fig. I. of Pl. XII.), the genital system of the Mendocino County specimens. The question of specific identity is also difficult in living specimens. The digestive system of the same form is figured on Pl. XIII. Fig. 3, of Ann. N. Y. Lyc. l. c. It quite resembles that of *Arion hortensis* as figured by Leidy in Vol. I. It is much more simple than that of *Ariolimax.* The salivary glands are very broad and very arborescent, and form a broad collar around the œsophagus and commencement of the stomach. The last-named organ is very broad. This variety has been received by me from Dr. Cooper under the name of *Arion Andersoni.* If it really be that species, it may retain its specific name, but must be considered still a true *Prophysaon.* Cooper's *description* of *A. Andersoni* does not agree with this slug, especially as to the presence of a caudal mucus pore.

VERONICELLA, Blainville.

Animal limaciform (Vol. III. Pl. LXVII). Body oblong-oval when contracted, more or less linear when extended; mantle covering the whole body; foot narrow, wrinkled transversely as if composed of numerous rings, simple posteriorly; head distinct, and capable of being retracted under the mantle; buccal mass with a jaw and with papillæ arranged around the mouth; tentacles two, bifid, unequal, contractile; eye-peduncles long and slender, annulated, obtuse and oculiferous at tip. Pulmonary cavity on the right side, at about two fifths the length of the animal, and opening, by means of a tube running along the side, at the posterior extremity, between the mantle and the free point of the foot, in company with the anal opening. Organs of generation separate and distant, the male organ protruding at the base of the right tentacle; the female opening about the middle of the right side. Mucus pore none. No distinct locomotive disk, though by the wide overlapping of the mantle the whole base of the animal is tripartite.

Shell none.

There are but few known species of this genus, found in South America, the Philippines, South Africa, and the West Indies and Mexico (whence it ranges into Southern California). Our single Florida species belongs rather to the fauna of tropical than North America.

The name *Vaginula*, sometimes used for the genus, was published several years after *Veronicella;* it is now applied to an agnathous genus resembling outwardly *Veronicella* (Stolicska, Journ. Asiatic Soc. of Bengal, n. s. xlii. Part II., pp. 33 – 37).

The anatomy of *Veronicella* is given in Vol. I. Pl. IV.

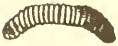
The contractility of the animal is very great. When extended it is very long and slender, and smooth or faintly reticulated, three or four times as long as when contracted; in which latter state it has an oblong form, equally rounded at both ends, and its surface is coarsely wrinkled, granular or tuberculated. The tentacles are generally bifurcate at tip, or rather there is a supplementary tentacle or spur, which can be protruded just short of the point of the tentacle; sometimes the tips are said to be even palmate. In the plate the tentacles are simple (see below, p. 241).

It lives in families under stones and trunks of trees, and sometimes buried in the earth. It is capable of retiring from damp places, and sometimes inhabits very dry localities. It issues forth in the night and on wet days, when it may be found upon trees. Its movements are very rapid; no slimy traces are left behind them as in the case of the *Limaces.*

The eggs are large and oval, ten or fifteen being joined together in a necklace-like gelatinous thread, which is coiled and more or less covered with mucus.

Jaw (Fig. 140) low, wide, thick, slightly arcuate; ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous, stout, crowded ribs, denticulating either margin, 24 in *V. Floridana.*

Fig. 140.



Jaw of *Veronicella Floridana.*

Lingual membrane very broad, arranged as usual in the *Helicinæ*, the transverse rows being, however, almost horizontal. By Fig. P of Pl. V., representing *V. Floridana*, it will be seen that the teeth are of a very peculiar type.

The lingual membrane is long and very broad, comprising (in the Florida species) about 60—1—60 teeth. The centrals have their base of attachment quite small, long and narrow, attenuated to a point above, gradually enlarging towards the base, above which are lateral, bluntly pointed, wing-like expansions; the lower margin is broad, and has a deep, rounded excavation; in some cases the lateral expansions are so produced as to give an almost cruciform appearance to the base of attachment; below the centre of the base of attachment, on its anterior surface, is a stout, blunt, short, simple cusp, ending in a short, stout cutting point.

The lateral teeth are very irregular in shape, but retain the bicuspid character peculiar to the *Geophila;* they are longer and much wider than the centrals; the bases of attachment are very irregular in shape, very asymmetrical, subquadrate or irregularly excavated above, thence curve outwards and downwards, until at their lower extremity they exhibit the lateral expansions and basal excavation of the central tooth, but both these characters are much more developed than in the centrals, and from the want of symmetry in the teeth are found only on the outer side of each tooth; the upper edge is squarely reflected, the reflection is very large, extends half-way to the lower edge of the base of attachment, and is produced beyond that into a blunt, stout cusp bearing a stout cutting point; the side cusps are almost obsolete, the inner one is much larger than the outer one, neither with distinct cutting point. The marginal teeth are a simple modification of the laterals, being reduced to a subquadrate shape, with the cutting point of the cusp much more produced.

I give on Pl. V. Fig. P, a group of central and laterals in *a*, a marginal in *b*.

I have not been able to examine *V. olivacea*, the only other species found within our limits.

For genitalia see below, under *V. Floridana.*

Veronicella Floridana, BINNEY.

Vol. III. Pl. LXVII.

Animal (contracted in alcohol) elongated-oval, about four times as long as broad, the sides very slightly curved, and the extremities circularly rounded; back convex, regularly arched in every direction; surface very slightly wrinkled; color dark ashy-gray, mottled with black, with a median whitish line, on each side of which, at about one third the distance towards the margin, is an ill-defined stripe of black; beneath drab-colored; foot occupying about one third the width; eye-peduncles short, annulated, the tentacles not very distinctly bifurcate. Length, 56 mill.; breadth, 18 mill.

Vaginulus Floridanus, BINNEY, Terr. Moll., II. 17, Pl. LXVII. (1851). — LEIDY, T. M. U. S., I. 251, Pl. IV. anat.

Veronicella Floridana, CHENU, Man. de Conch., I. 472, Figs. 3501, 3502 (1859). — W. G. BINNEY, L. & Fr.-W. Sh., I. 305 (1869). — TRYON, Am. Journ. Conch., III. p. 317 (1868).

Jaw arcuate, narrow, ends rounded, anterior surface with 24 ribs, crenulating the concave margin. (Fig. 140.)

Lingual membrane: see pp. 240, 241. (Pl. V. Fig. P.)

Has been found at a single locality, namely, at Charlotte Harbor on the west coast of Florida.[1]

The above description is obviously very imperfect, inasmuch as it is drawn from a dead and greatly contracted specimen, and as no notes of the animal have been found excepting as to its locality. The characters, however, are sufficiently marked to distinguish the species. From its slight reticulation, in its contracted state, it must have been quite smooth when extended. Its colors are similar to those of *Tebennophorus Caroliniensis*, and similarly distributed. The tentacles are not very conspicuously spurred, but the puncture for the protrusion of a spur is manifest.

The genitalia are figured by Leidy (l. c.) A remarkable peculiarity of this genus is the removal of the male and female portions of the sexual apparatus from each other. The former, except the testicle and prostate gland, occupies the usual position, but opens externally between the mouth and olfactory orifice; the latter is placed in the middle inferior part of the visceral cavity, and opens exteriorly on the right side, inferiorly just posterior to the middle of the body.

The testicle is situated between the posterior part of the stomach and the liver, on the right side. It is not lobulated, but has the same aciniform arrangement as in other limaciform genera. The epididymis is moderately tortuous, and becomes the vas deferens at the junction of the ovary with the oviduct. The vas deferens takes a remarkable course to get to the penis. It is at first attached for a short distance to the commencement of the oviduct, which it leaves, and then winds around its lower extremity, where it is joined by a comparatively very small prostatic gland. It continues its attachment to the lower part of the oviduct to the junction of the latter with the duct of the generative bladder, where it receives a small duct from the duct of the latter organ, and then passes nearly to the external female orifice, where it turns abruptly forwards between the muscular peritoneum and the right edge of the podal disk, and continues this course to the head. It now turns abruptly backwards to the right, and again appears within the visceral cavity, and passes to the base of the penis sac.

The penis is a conico-cylindroid, contorted organ, contained within a thin, muscular sheath. Its apex presents a small, round papilla, or glans; and into its base is inserted the retractor muscle, which arises just anterior to the pulmonary cavity. The lower part of the preputial sheath of the penis is joined by the common duct of a highly developed, multifid vesicle. This latter organ consists of twenty-five long, narrow, cylindrical, blind tubes, contorted at their termination, and opening separately into a common tube, containing, in the specimen examined, attached to its bottom, a narrow, cylindroid organ, which probably may have been an uncalcified dart.

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[1] Stearns refers it also to Nicaragua, I but doubt its being so widely distributed.

The tube formed by the prepuce and the duct of the multifid vesicle, as previously mentioned, opens exteriorly immediately beneath the mouth. The ovary is small and unusually lobulated. The oviduct is a narrow, cylindrical tube, which winds forwards and then back again so as to form a double spiral, after which it makes a curve downwards, and is joined by the duct of the generative bladder. The latter organ is globular; its duct is short, gradually increases in breadth, and is spirally twisted. From the duct, as previously mentioned, passes a small offset to the vas deferens. The common duct of the bladder and oviduct, or vagina, is cylindrical, and just before terminating, is joined by a short, wide tube, derived from a large, oval sac, which is filled with a delicate, reticulated substance. This sac is peculiar to *Veronicella;* its use is problematical.

The position of the female orifice of generation has been already stated.

Veronicella olivacea, STEARNS.

Animal elongated-oval, slug-shaped, sides moderately curved, ends obtusely rounded; substance (in alcohol) coriaceous, back convex and granulously rugose; color olive beneath, darker olive above; length of body nearly four times its width; foot linear, not quite as long as, and one third the width of, the body; eye-peduncles short, annulated, with rather obscure stumpy (bifurcate ?) tentacles below.

Length of largest specimen, 1.74 inches. Breadth of largest specimen, .51 inch.

Habitat: Nicaragua (Occidental department), where several specimens were collected by Mr. J. A. McNiel. This species is found also in the Upper Californian Province, a specimen having been collected by me near Lobitos, in the year 1866.

My collection contains three specimens, and the Museum of the Peabody Academy of Science, at Salem, Massachusetts, numerous examples of this species. In connection with the above measurements, it should be borne in mind that the contraction caused by the alcohol materially affects the proportions; the animal, when alive, is undoubtedly very much longer, and somewhat broader, than above stated.

The few species known inhabit tropical or semi-tropical climates; the form above described is quite distinct from *V. Floridana*, which is also found in Nicaragua (Eastern department), where it was collected "under stones, Javate, Chontales; probably the same species, but twice the size of Toro Rapids." Vide paper "On the Land and Fresh-Water Shells of Nicaragua, by Ralph Tate," in American Journal of Conchology, Vol. V. pp. 151 – 162. The "Toro Rapids" specimens of Mr. Tate's collection possibly belong to the species herein described, but it is hardly probable that the well-marked differences between the latter and *V. Floridana* could have escaped detection.

The above is the original description from Proc. Boston Soc. Nat. Hist.

SPURIOUS SPECIES OF VERONICELLA.

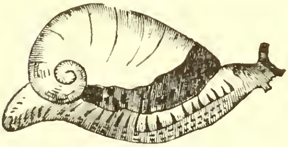
The following species are catalogued by GRATELOUP among the American *Vaginuli* (Dist. Geog. des Limaciens, 22). They were all described by Rafinesque, and by him placed in his genus *Philomycus* (see Binney and Tryon, reprint). From the general inaccuracy of that author, as well as the deficiency of the descriptions, I think they should be excluded from this or any genus: —

Vaginulus flexuolaris, *Vaginulus oxyurus*,
Vaginulus fuscus, *Vaginulus quadrilus.*

BINNEYA, J. G. COOPER.[1]

Animal heliciform, obtuse before, rapidly acuminated behind; mantle subcentral, extending anteriorly beyond the shell; a distinct locomotive disk; no caudal mucus pore; respiratory orifice posterior, on the right edge of the mantle; anal orifice contiguous to last; genital orifice behind the right eye-peduncle.

Fig. 141.

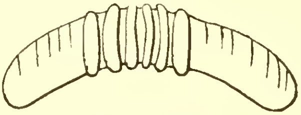


B. notabilis, partially extended, enlarged.

Shell entirely external, ear-shaped, nearly flat, about one third as long as the animal, which it does not half cover when retracted. Spire flattened, forming two horizontal volutions, last whorl enormously expanded and slightly arched. Columella distinct, entire, hiding the interior of the convolutions; peristome simple, acute. In estivation the part of the animal excluded from the shell is protected by a thick, white, parchment-like epiphragm.

A genus of the Mexican fauna, whence it has been introduced on Guadelupe Island off the west coast of Mexico, and Santa Barbara Island, coast of California.

Fig 142.



Jaw of *B. notabilis.*

The jaw is thick, slightly arcuate, ends blunt; anterior surface with six well-developed ribs, denticulating either margin, situated on the central third of the jaw, and as many subobsolete ribs on each outer third; no median projection. (Fig. 142.)

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[1] Animal heliciforme, antice obtusum, postice rapide acuminatum. Pallium subcentrale, extra testam antrorsum prolongatum. Discus gressorius distinctus. Porus mucosus caudalis nullus. Apertura respiratoria et analis ad dextram sita, in parte posteriore marginis pallii. Apertura genitalis post tentaculam dextram oculigeram.

Testa externa, paucispira, haliotoidea, animal non includens. Pars exclusa in hibernis epiphragmate albido, duro, membraneo protecta.

Maxilla arcuata, costis validis exarata. Dentes linguales quadratæ, centrales tricuspidatæ, laterales et marginales bicuspidatæ.

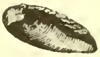
Lingual membrane, as usual in the *Helicea* (Pl. V. Fig. K), long and narrow. Teeth 31—1—31, with about 15 laterals, but the change into marginals is very gradual, the latter being a simple modification of the former. My figures give a central with the first, sixteenth, and thirty-first teeth.

See remarks under *Binneya notabilis*.

Binneya notabilis, J. G. Cooper.

Shell imperforate, depressed orbicular, ear-shaped, opaque, thin, light horn-color, striated; spire scarcely elevated; apex obtuse; suture deeply impressed; 1½ whorls, the first half with about thirty revolving, separated, prominent, abruptly ending rib-like striæ, the last comprising almost the whole shell, depressed above, very rapidly increasing; aperture sub-horizontal, transversely oval, very large; peristome thin, acute, simple; columella arcuate, with a thin deposit of transparent callus; apex visible from below. Greater diameter 7, lesser, 3½ mill.; height, 1½ mill.; greatest transverse diameter of aperture, 7. Of a larger specimen, 14 mill. greater diam.

Fig. 143.



B. notabilis.

Binneya notabilis, J. G. Cooper, Proc. Cal. Acad. Nat. Sci., III. 62 (1863), figures. — Tryon, Am. Journ. Conch., II. 244 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 68, Fig. 112 (1869).

Santa Barbara Island, California; also Guadelupe Island off the coast of Mexico; probably a species of the Mexican fauna.

For views of the animal, jaw, and lingual dentition, see above.

Mr. Hemphill, who has contributed so largely to our knowledge of the land shells of the Pacific Coast, has lately visited the island of Santa Barbara. Among the species found by him is *Binneya notabilis*, which was originally described from thence by Dr. J. G. Cooper. Mr. Hemphill has kindly sent me living specimens, as well as others preserved in spirits. I am, therefore, able to give a full generic description, with a figure of the animal as it appears when half extended. I did not succeed in inducing it to protrude itself fully.

When received, the living examples were furnished with the peculiar epiphragm described by Dr. Cooper. On becoming again active, this epiphragm was left entire, still adhering to the surface on which the animal had formed it. In one individual I observed a second, inner epiphragm, simple, without the perpendicular walls.

The Mexican genus *Xanthonyx* is no doubt identical with *Binneya*, but it does not appear from the figures of alcoholic specimens given by Messrs. Fischer and Crosse (Moll. Mex. et Guat.) that the mantle of *Xanthonyx* is extended anteriorly, and the position given by them of the respiratory orifice is different. Should future study of the living animal prove my opinion correct, *Xanthonyx* will be considered as a synonyme.

Dr. Pfeiffer (Mon. Hel. Viv., VII. 4) suggests the identity of *Binneya* with *Daudebardia*, ignoring entirely the distinction of the first divisions now recog nized among the *Geophila* of presence or absence of a jaw, or of aculeate or quadrate teeth. By the modern arrangement these two genera are most widely separated.

The surface of the animal is dirty white, with about seventeen vertical rows, on each side, of dark blue or slate blotches, interrupted by the longitudinal reticulations running parallel to the foot, but again commencing and extending to the edge of the foot. These blotches diverge in all directions from under the shell and mantle, running almost perpendicularly on the side of the animal, but very obliquely in front and behind. The tail is quite keeled with oblique blotches. These blotches also run obliquely from a median line on the fore-part of the extended animal. Tentacles, eye-peduncles, and front of head slate-color. Lips developed and kept constantly in motion as tentacles. The reticulations of the surface are large and few.

In specimens preserved in alcohol there appears a locomotive disk. There is no caudal pore. The respiratory and anal orifices are far behind the centre of the mantle edge on the right of the animal. The genital orifice appears somewhat behind the right eye-peduncle. The mantle is scarcely reflected upon the shell, even in front. When the animal is fully extended, Dr. Cooper says the mantle equals one fourth of its length. The mantle exudes mucus freely. It seems fixed to the shell, not changing its position with the movement of the animal.

One of the shells collected by Mr. Hemphill is twice as large as that whose measurements are given by Mr. Bland and myself.

The jaw is thick, slightly arcuate, ends blunt; anterior surface with six well-developed ribs denticulating either margin, situated on the central third of the jaw, and as many subobsolete ribs on each outer third; no median projection (Fig. 142).

Lingual membrane (Pl. V. Fig. K) long and narrow. Teeth 31—1—31, with about 15 laterals, but the change into marginals is very gradual, the latter being a simple modification of the former. My figures give a central with the first, sixteenth, and thirty-first teeth.

The nervous ganglia and the digestive system present no peculiar features. The genitalia are figured on Pl. XI. Fig. B. The penis sac is long, narrow, tapering to its apex, where it receives the vas deferens; the retractor muscle is inserted below the entrance of the latter. The genital bladder is oval, on a long, narrow duct. There is a small, sac-like, accessory organ, probably a dart sac (*d*, *s*).

HEMPHILLIA.[1]

Animal limaciform, small, blunt in front, tapering behind. Mantle subcentral, large, oval, greatly produced in front, free around its margin and slightly reflected over the edges of the shell. No distinct locomotive disk to foot. Lines of furrows run near and parallel to edge of foot, rising above the extremity and apparently uniting over a transverse mucus slit, overhanging which is a greatly produced horn-shaped process. Respiratory orifice at right edge of mantle, near its centre. Generative orifice at right side of neck, near right eye-peduncle.

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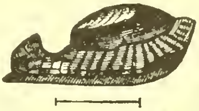
[1] Animal limaciforme, parvum, antice obtusum, postice attenuatum. Pallium subcentrale, magnum, ovatum, antice valde productum, marginibus liberis. Discus gressorius

Fig. 144.

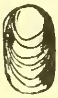


H. glandulosa, contracted in spirits.

Shell external, not spiral, its edges imbedded lightly in the mantle, very thin, unguiform, almost as large as the mantle (in specimens preserved in alcohol).

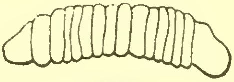
Jaw wide, low, slightly arcuate; ends blunt, but little attenuated; anterior surface with numerous ribs denticulating either margin (Fig. 146).

Fig. 145.



Internal shell of *H. glandulosa.*

Fig. 146.



Jaw of *H. glandulosa.*

Lingual membrane described below under *H. glandulosa.*

Oregon Region, at Astoria.

This curious slug, by its general outline and by the form and position of its shell, may be compared to *Omalonyx unguis* D'Orb, and the species known formerly as *Succinea appendiculata* Pfr., but now usually referred to *Amphibulima.* The former has, however, a jaw with the supplementary extension as in *Succinea*, the latter has the jaw usual in *Bulimulus* and *Cylindrella*, while neither of them has the prolongation of the mantle. Both of those genera also are readily distinguished by their shell being more developed and approaching a spiral form.

Hyalimax is distinguished from *Hemphillia* by its Succinea-like jaw. Otherwise, it resembles our genus in its general outward appearance, and by its non-spiral shell. This shell, however, in *Hyalimax* is almost, if not completely, internal, while the shell of *Hemphillia* is entirely exposed.

Binneya, in its prolonged mantle and costate jaw, resembles *Hemphillia*, but its shell is much more developed, spiral, striate and almost capable of protecting, though not absolutely including, the animal when contracted.

Xanthonyx and *Simpulopsis* are both described with costate jaw, but they have both highly developed, decidedly spiral shells.

Finally, from all the above-mentioned genera, and from all known sublimaciform genera, our genus is at once distinguished by the peculiar hump-like

distinctus nullus. Porus mucosus transversus in apice pedis, processu coniforme valido protectus. Apertura respiratoria ad dextram, in medio marginis inferioris pallii, genitalis ad basin tentaculi dextri oculigeri.

Testa externa, unguiformis, subquadrata, replicatura pallii marginorum breviter inclusa.

Maxilla et lamina lingualis ut in *Arione* constituta, dentes centrales tricuspidatæ, laterales bicuspidatæ, marginales quadratæ, bicuspidatæ, papillis internis valde productis, externis subobsoletis.

process on the tail, reminding one of the caudal process in some of the genera of disintegrated *Nanina*.[1]

Hemphillia glandulosa.

Animal from 12 to 30 millimetres long (preserved in alcohol); color smoky white, mottled with longitudinal, dark brown blotches, running obliquely from the edge of the mantle to the foot, uniformly with the coarse granulations, of which there are about twenty-five on either side of the animal. Caudal process very large, triangular in profile, dark brown, with a few coarse granulations.

Shell unguiform, slightly convex, light horn-color, very thin, its edges almost membranous, with prominent concentric lines of growth ; 5 mill. long, 3 mill. wide in a specimen of twelve mill. length (Fig. 145).

Hemphillia glandulosa, BLAND and W. G. BINNEY, Ann. Lyc. Nat. Hist. of N. Y., X. 209, Pl. IX. Figs. 1, 3 (1872).

Astoria, Oregon, in the Oregonian Region.

The description is drawn from specimens preserved in alcohol, due allowance for which fact must be made. They were collected at Astoria, Oregon, oy Mr. Henry Hemphill, to whom Mr. Bland and myself dedicated the genus in return for most valuable addition to our knowledge of the land shells of the Pacific Coast.

Jaw thick, low, wide, slightly arcuate, ends attenuated, blunt; cutting margin without median projection ; anterior surface with about 14 crowded, stout, irregularly developed ribs, denticulating either margin (Fig. 146).

Lingual membrane (Pl. V. Fig. J) long and narrow. Teeth 23—1—23, with 11 perfect laterals. Centrals with a quadrangular base of attachment, higher than wide. Reflection about half as long as this base, with a long, narrow median cusp reaching the lower margin of the base of attachment, beyond which projects slightly the short cutting point; side cusps but little developed, but bearing short, stout triangular cutting points. Laterals like the centrals, but asymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the inner side cutting point. First marginal (*b*) with a square base of attachment, broadly reflected into a stout cusp, bearing an inner, stout, very long, bluntly ending, oblique cutting point, and a small outer cutting point. Outer marginals (*c*) low, wide, the reflection broad, reaching the lower edge of the base of attachment, and bearing one inner, long, oblique, blunt cutting point, and a small outer cutting point.

The genitalia are figured (Pl. XII. Figs. J, K). The testicle is composed of a large globular mass of aciniform cæca. It lies loosely upon, not imbedded in, the upper lobes of the liver. The ovary and oviduct are as usual. The genital bladder is globular, very large, on a short stout duct, entering the vagina near its base. The penis sac is long, cylindrical, larger towards its apex, where both the retractor muscle and vas deferens enter. In several specimens examined, the penis sac appeared somewhat different. It had a large globular bulb at its apex. The vas deferens entered beyond the middle of the length of the sac; it was greatly swollen before entering the sac, for a distance equalling about one half of the length of the sac. At the commencement of this swelling the retractor muscle was inserted. This form of penis sac is figured in Fig. K.

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[1] Mr. Hemphill informs me that in the living animal this hump-like process is less conspicuous than in specimens preserved in alcohol. The shell is central, and much broader than the animal when in motion.

The balance of the anatomy of *Hemphillia* seems to be as in the other slugs.

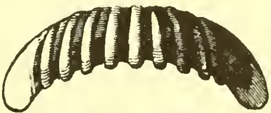
PALLIFERA, Morse.

Generic characters as in *Tebennophorus* with the exception of the ribs on the jaw. This is an instance of the arbitrary separation of generally allied species on account of the difference of one single character. This is the more unsatisfactory, because the presence or absence of ribs on the jaw may not prove a reliable generic character. It certainly is not so in *Dentellaria* (see p. 45).

Confined to the Northern Interior Regions.

Jaw stout, arcuate, ends but little attenuated, blunt; anterior surface with stout separated ribs, 9 in *P. dorsalis* (Fig. 147), over 15 in *P. Wetherbyi*. The jaw of the latter is arched, and has a blunt median projection, broken by the ends of the ribs. These last are more irregularly developed also.

Fig. 147.

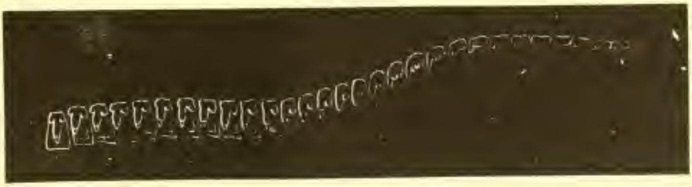


Jaw of *P. dorsalis*.

The arrangement of the teeth on the membrane in *P. dorsalis* is as usual in the *Helicea*. See Fig. 148. Separate teeth of the same species are more correctly drawn on Pl. V. Fig. L.

Mr. Morse gives 115 rows of 56—1—56 teeth each, with perfect laterals. In the specimen examined by me I found 29—1—29 teeth, with 14 perfect laterals, a difference sufficiently great to raise a doubt of the specific identity of the two specimens. The central teeth have a base of attachment longer than wide, with short lines of reinforcement running parallel to the outer edges at the

Fig. 148.



Lingual dentition of *Pallifera dorsalis*.

lower margin. The upper margin is reflected. The reflection extends about one third of the length of the base of attachment; it bears a central, stout, well-developed cusp, and one small, little-developed, rounded cusp at each side; all three cusps have stout cutting points. The lateral teeth are like the centrals, but asymmetrical by the suppression of the inner cusp and cutting point, and inner, lower, lateral expansion of the base of attachment. The marginal teeth are low, wide, broadly reflected, the reflection equalling the length of the base of attachment, and very irregularly denticulated, there being usually one long, blunt, oblique, inner, bifid cutting point, the outer division much the shorter, and several short, blunt, outer cutting points.

Pallifera dorsalis, BINNEY.

Vol. III. Pl. LXIII. Fig. 3.

Color of upper surface ashy, with a shade of blue, an interrupted black line extending down the centre of the back; eye-peduncles black, about one eighth of the length of the body; tentacles blackish, very short. Body cylindrical and narrow, terminating posteriorly in an acute point; base of foot white, very narrow, its separation from the body not well defined. Upper surface covered with elongated and slightly prominent glandular projections, the furrows between indistinct. Respiratory orifice very minute, situated on the right side, about one eighth of an inch behind the insertion of the eye-peduncle. The mantle is closely connected with the body. Length, 18 mill.

Philomycus dorsalis, BINNEY, Bost. Journ. Nat. Hist., IV. 174 (1842); Proc. Bost. Soc. Nat. Hist., 1841, 52. — ADAMS, Shells of Vermont, 163 (1842). — GRAY & PFEIFFER, Brit. Mus. Cat., 159. — TRYON, Am. Journ. Conch., III. 317 (1868).

Limax dorsalis, DEKAY, N. Y. Moll., 22 (1843).

Tebennophorus dorsalis, BINNEY, Terr. Moll., II. 24, Pl. LXIII. Fig. 3 (1851). — W. G. BINNEY, Terr. Moll., IV. 31; L. & Fr.-W. Sh., I. 301 (1869). — GOULD and BINNEY, Invert. of Mass., ed. 2, 460 (1870).

Pallifera dorsalis, MORSE, Journ. Portl. Soc., I. 8, Fig. 5; Pl. III. Fig. 6 (1864).

Vermont, Massachusetts, New York, thus appearing a species of the Northern Region. From Kentucky I have received specimens of this or an allied species; it may therefore extend into the Interior Region.

This animal is found in woods and forests, in the soil under decaying trunks and logs. It is lubricated by a watery mucus which is not secreted in quantity sufficient to preserve its life when removed from its native haunts and exposed to the air. It is even difficult to preserve it long enough for examination, as it becomes dry, diminishes in bulk more than one half, and dies. We have seen many specimens. They were very active in their movements, and one of them suspended itself by a thread of mucus, in the manner of the *Limaces*. It sometimes climbs trees. Our specimens were found in Vermont. Dr. Gould has recognized this or a similar species near Boston.

It is quite possible that this is one of the species described by Rafinesque; but from the poverty of his descriptions, we are unable to identify it with either of them.

When Dr. Binney for the first time procured this animal, not being able to distinguish the separation of the margin of the mantle from the edge of the foot, he felt assured that it must be a species of Rafinesque's genus *Philomycus*, and he accordingly described it as such. Having an opportunity since that time of examining several of them, he noticed, on throwing some of them into alcohol for preservation, that the contraction caused by the liquor revealed and detached the mantle from its adhesion. Its characters, therefore, correspond with those of the present genus.

For jaw and dentition, see above and Pl. V. Fig. L.

Pallifera Wetherbyi.

From near the mouth of Laurel River, Whitley County, Kentucky, Mr. A. G. Wetherby collected many specimens of what appeared to be a small species of *Tebennophorus*. It was readily distinguished from the numerous young of *T. Caroliniensis* found in the vicinity by the arrangement of the blotches of color, they being in irregular, interrupted, transverse bands, instead of running longitudinally as in that species. The anterior portion of the body seemed also to be more swollen, and the posterior extremity to taper more rapidly than in *Caroliniensis*. On examining the jaw I found it to be ribbed, a character placing the slug in the genus *Pallifera*. The presence of ribs was verified in four individuals. Small specimens of *T. Caroliniensis* from the same locality had the usual ribless jaw of *Tebennophorus*. It appears, therefore, that the slug must be considered a new species of *Pallifera*. I have named it after its discoverer. It is difficult to draw more satisfactory specific characters from specimens preserved in alcohol. One of them in its contracted state measures 12 millimetres in length. Subsequently, I received specimens in which the blotches run longitudinally.

Pallifera Wetherbyi, W. G. BINNEY, Ann. Lyc. of Nat. Hist. of N. Y., XI. 31, Pl. II. Fig. 12 (1874).

Jaw arcuate, ends blunt, but little attenuated; anterior surface with decided, separated, unequal ribs, denticulating either margin, about 15 on one specimen, those at the ends being less developed than on the balance of the jaw; cutting edge with a decided, short, blunt, median projection. (See plate referred to.)

The lingual membrane (Pl. V. Fig. M) has 35—1—35 teeth, with 13 perfect laterals. The teeth are different from those of *P. dorsalis*, and nearer those of *Tebennophorus Caroliniensis*. The side cusps of the centrals and laterals are subobsolete, and have no distinct cutting points; the median cusp is much more produced, stouter, and bears a stout, blunt, cutting point. The marginal teeth are not so wide, they are less irregularly denticulated, having usually one long, stout, blunt, oblique, inner cutting point, and one shorter side cutting point.

HELIX, LIN.

In common with all who have studied the Pfeifferian genus *Helix*, I am convinced of the necessity of recognizing among its species numerous distinct genera. I have, however, up to this time eliminated those species only whose jaw has no distinct ribs upon its anterior surface. The balance of the species I retained grouped as subgenera only. Before recognizing these groups as distinct genera, I desired to wait until we can ascertain whether generic characters can be found in the jaws and lingual dentition as well as in the shells. Convinced that characters cannot be found in these organs or in the genitalia, I now adopt the dismemberment of the genus so much demanded by the number of its species, founding the distinction on the shell alone. I shall discuss the constancy of the jaw and lingual dentition under each group, as far as our material will allow. In this place I will merely mention that in general terms it may be said that *Pomatia*, *Tachea*, *Euparypha*, *Arionta*, and *Aglaja* have few, separated ribs, usually grouped near the centre of the jaw, leaving both extremities without ribs. *Mesodon*, *Triodopsis*, and *Polygyra* have numerous, separated ribs spread over the whole of the jaw. *Stenotrema* has numerous stout, crowded ribs also spread over the whole surface of the jaw. The ribs are also numerous, crowded, and similarly disposed in *Strobila*, *Gonostoma*, *Dorcasia*, and *Fruticicola*, but they do not so deeply denticulate both margins as in the genera mentioned above. All the above have a high jaw. The following have a much lower jaw; *Vallonia*, with numerous crowded ribs slightly denticulating the margins, especially the lower one; *Acanthinula*, with similar ribs, but quite arched; *Glyptostoma*, with still more numerous, separated ribs, deeply denticulating either margin; and *Polygyrella*, with more numerous ribs, and proportionally much wider to its height than in any of the other North American subgenera. Thus there seems to be some distinctive subgeneric character to the jaw. It must, however, be borne in mind that there are exceptions in some of the subgenera where the species are numerous; thus, in *Arionta* I found numerous ribs in *ruficincta*, though the other species have but few. The number, disposition, and size of the ribs vary within certain limits in different individuals of the same species. I have repeatedly found this to be the case.

In regard to the generic value of the type of lingual dentition, I can only say in general terms that within certain limits it may prove reliable. Here again, however, we find the type of dentition inconstant when many species are known. Thus in *Arionta* we find *Townsendiana* quite differing from the other known species (see below). In *Mesodon*, also, I find two quite distinct types of dentition, and under each genus I have pointed out the variation observed. I am convinced that the presence or absence of side cusps to central and lateral teeth is not a reliable subgeneric character. The same may be said of the side cutting points. The marginal teeth offer more reliable characters. They are very peculiar in *Vallonia* and *Strobila*, in being very low and wide, and having numerous cutting points, quite resembling those of *Pupa*. In *Mesodon*, *Triodopsis*, and *Arionta*, the marginals are longer than wide, with only two, sometimes bifid cutting points. In *Stenotrema* and *Polygyra* they are rather wider than long, also with two more bluntly bifid cutting points. It must be borne in mind, however, that my observations have not led me to believe these characters sufficiently constant to be of generic value. There is also some variation in the mode of passing from lateral to marginal teeth, even in the same genus; in some cases the transition being made simply by a gradual modification of form, in others by the splitting of the inner cutting point. These points will be treated more fully under each genus.

Descriptions of the genitalia of each species observed are given below. A few general remarks are here added on the general arrangement of the organs in the group of genera formerly known as *Helix*, including even the *Zonites*, for the purpose of more convenient comparison.

The testicle, very unlike that of slugs, is imbedded or commingled with the parenchyma of the posterior or superior lobe of the liver; and, instead of having an aciniform appearance, it is composed of fasciculi of short cæca. It is usually of a lighter color than the liver. The epididymis is long, and generally very much convoluted, and contains a white, silky, tenacious substance, often distending the tube to a considerable degree, composed of spermatozoa. At its junction with the prostate gland, it always receives the duct of a small accessory gland, composed in different species of *Helix*, of from three to nine acini.

The prostate gland is generally larger than in the *Limaces*.

The vas deferens generally corresponds in length with the curve passing from the termination of the prostate gland downwards to the cloaca, and thence to the summit of the penis. Generally, it is a white, narrow, cylindrical, frequently undulated tube. Sometimes it is distinctly and strongly muscular. In some species at its commencement it presents a dilated and glandular appearance. In *Patula solitaria* it is much dilated, annulated, and glandular at its termination. In most instances it joins the summit of the penis sac; in some, however, it joins the penis sac at the side, very near the summit.

The penis sac varies very much in form and size; most usually it partakes of a conico-cylindroid form. In some species it is very large and long, cylindrical, collapsed, and flaccid. In others it is long, clavate, and bipartite at the summit, or it is short, stout, and clavate. In many species it has a thick, preputial membrane, originating around its base, and rising upwards so as to envelop it for one or two thirds of its extent. In *M. profunda* the base of the penis protrudes into a sheath joining the cloaca, in the form of a cone with its apex bent upon itself. In *Z. suppressus*, it is wholly enveloped in a sheath derived from a tubular offset from the duct of the generative bladder.

The muscular tunic of the penis is thick and strong. The internal lining mucous membrane usually presents a number of large rugæ, longitudinal and oblique; frequently there is but a single, large, longitudinal fold. At the point of entrance of the vas deferens there is generally one or two pendant, valve-like folds of the lining membrane.

In some species the surface of the membrane is everywhere distinctly papillated; in the others it is smooth.

The retractor muscle is, in almost all cases, inserted into the summit of the penis, or into the vas deferens near its termination in the latter. In the excepted cases it is inserted into the side of the penis, above its middle. In *multilineata* there are some accessory fibres passing from the latter to the prepuce; in *profunda* to the base of the penis; in *albolabris, tridentata*, etc., from the vas deferens to the prepuce. The penis joins at its base the cloaca.

The ovary has the same general form and color as in slugs, but rarely presents anything more than a trace of lobuli, usually having a uniform, homogeneous appearance. The oviduct does not differ from that of the slugs. Its neck is usually narrow, and of variable length, and is joined at the lower part by the duct of the genital bladder, to form the vagina. In *multilineata*, the neck is long, dilated at its lower part, and strongly muscular, and its internal surface presents a number of longitudinal rugæ. In *profunda* and *fuliginosus*, it is long, cylindrical, and strongly muscular.

The genital bladder, constantly existing, presents considerable variation in the form, size, and length of the duct. It is generally subrotund, oval, or pyriform in shape, and large. The duct is sometimes wide, as long as the oviduct, and dilated at its lower part. In other cases it is as long as the oviduct, and narrow, or it is rather more than half the length of the oviduct. In the remaining cases, generally, the bladder reclines upon the lower part of the prostate gland, and its duct is about the length of the neck of the oviduct. In some it does not reach the prostate gland, and so gradually passes into its duct as to be a mere long, cæcal tube. In others the duct of the bladder is as short as that of *Arion*. Usually, the surface of the bladder is smooth; in *profunda* and *exoleta* it is transversely folded; in *fuliginosus* it is regularly, longitudinally folded. In *multilineata* the duct of the bladder at its termination dilates, and is strongly muscular. In *solitaria* the lower third is dilated. In *fuliginosus* and *profunda* it is strongly muscular, the greater part of its extent. In *albolabris, palliata, tridentata*, etc., it is dilated to the size of the bladder, is strongly muscular, and internally presents a number of regular, longitudinal folds, sometimes undulated at the sides, extending to the lining of the bladder in the form of line-like plicæ. In *ligerus, intertextus, gularis*, and *suppressus*, an offset from the duct of the bladder passes down, and encloses the penis, dart sac, and cloaca.

The vagina, or common duct of the oviduct and duct of the genital bladder, holds no correspondence with the length of the penis; it is always shorter, usually not more than one third the length, and is also narrower. In *fuliginosus* it is surrounded by a thick, glandulous body.

In *ligerus, intertextus, gularis*, and *suppressus* there exists, opening into the cloaca, a curved, cylindrical, strongly muscular dart sac, longer and narrower than the penis. The bottom of the tube, for one fourth the length of the latter, is occupied by the papilla from which arises the dart. The muscular layer, for more than half the length of the tube, at the middle of the latter closely envelops the dart, and terminates abruptly below in a sort of papilla, from which the point of the dart projects into the lower part of the tube. The dart is usually a very long, narrow, curved, cylindrical, tubular, flexible, calcareous spiculum, terminating in a sharp spear-point. At the base of the dart there opens into the dart sac, in *ligerus* and *suppressus*, a single, short, pyriform follicle, the simplest homologue of the multifid vesicle. In *intertextus* and *gularis* there is a pair of such follicles. Those organs, the dart sac and multifid vesicles, so common in European species, are very rare in American species excepting *Arionta*, which also usually has the flagellate form of penis. A rudiment, or simplest condition of the multifid vesicles, only exists in *intertextus* and *gularis*, in which there is a single pair of follicles, and *ligerus* and *suppressus*, in which there is but one short follicle. The dart sac exists certainly in the four latter species, probably in *Berlanderiana*. In the species of the West Coast now referred to *Arionta*, the dart sac is very common, and also various complications of vaginal prostates described under each species; the duct of the genital bladder has often a long, accessory duct.

The above summary, however imperfect, will serve to show how very variable are the genital organs. They cannot be relied on as generic characters, but are often of great value in distinguishing species.

Doubtful, Spurious, Extralimital Species of Helix.

The following list does not contain the names of our species of dismembered *Helix*: —

Helix —— (Sheppard, Trans. Lit. and Hist. Soc. Quebec, I. 194). — Shell thin, conoidal, perforated ; spire very flat ; margin of lip reflected.

Common in the same place as the above (*H. hortensis*, Plains of Abraham, Quebec) ; it is a much less shell, with a brown epidermis ; the penultimate whorl has an elevated white ridge near the aperture, which appears to be some remains of the last year's lip. (Sheppard.) [= *H. rufescens*?]

Helix Sagraiana, D'Orbigny, a Cuban species, is erroneously attributed to California (on the authority of Sowerby) by Pfeiffer (Mon. I. 325) and Carpenter (Report, p. 214).

Helix Sandiegoensis, Lea, is mentioned by name only by Gould, Pac. R. R. Rep., V. 331.

Helix attenuata, Lake Superior, etc., is given without description by J. de C. Sowerby, in Richardson's Fauna Boreali-Americana (III. 315), together with

Helix gularis,

Helix rudis, and

Helix paludosus (= *H. minuta*).

Helix angulata, Sheppard, is quoted as a synonyme of *Planorbis campanulatus*, by J. de C. Sowerby, in Fauna Boreali-Americana, III. 315.

Helix pallida, Budgin, Virginia, is quoted as a synonyme of an unnamed *Helicella* by G. B. Sowerby (Tankerville Coll., 37), and

Helix corrugata, BUDGIN, is quoted by the same (p. 42) as a synonyme of *Limnœa corrugata*, and

Helix viridata, BUDGIN, Virginia, is quoted by the same (p. 43) as a synonyme of *Paludina viridis*, and

Helix imperfecta, BUDGIN, is quoted by the same (p. ix. of Appendix) as a synonyme of *Melania inermis*.

Helix minuta, TRUE (Proc. Essex Inst., II. Pt. 2, p. 193, Salem, Mass., 1860). — Shell minute, rounded conical, smooth, apex obtuse; epidermis of a uniform reddish horn-color; whorls 4, rounded above and below, with a well-defined suture; aperture rounded, lip simple and thin, umbilicus broad and deep. Diameter about one-twentieth inch.

Helix peregrina (Bosc, Hist. Nat. des Coq., IV. 57, 1830). — Ovale, imperforée; les tours de spire écartés, décroissants également, l'ouverture ovale.

Schwet. Einl. in Conch., II. Tab. IV. Fig. 11. Se trouve dans les iles de la côte ouest de l'Amérique. (Bosc).

Helix Rowelli, NEWCOMB (see L. & Fr.-W. Sh., I. 185), has been accredited to Arizona, but not on undoubted authority. I have not included here the Lower California species, for which see pp. 20, 21.

Helix radiata, LISTER (Europe and Virginia), of Bosc, Hist., IV. 32, appears to be *H. alternata*, as reference is given to Lister's figure of that species.

Helix trivolvis, EATON (Zoöl. Text-Book, p. 194) = *Planorbis*.

Helix bicarinatus (*id.* 194) = *Planorbis*.

Helix parvus (*id.* 195) = *Planorbis*.

Helix catascopius (*id.* 195) = *Limnœa*.

Helix heterostrophus (*id.* 195) = *Physa*.

Helix subcarinatus (*id.* 195) = *Lioplax*.

Helix Virginica (*id.* 195) = *Melania*.

Helix vivipara (*id.* 196) = *Vivipara contectoides*.

Helix decisa (*id.* 196) = *Melantho*.

Helix Cumberlandicus, LEA, of WHEATLEY'S Cat. U. S. p. 18, is the same, I presume, as *Patula Cumberlandiana*.

Helix immitissima, LEA, of the same, p. 19 = *H. minutissima?*

Helix pallida, SAY, of same = *H. palliata?*

Helix depicta, GRATELOUP, Soc. Lin. Bordeaux, XI. 399, Pl. I. Fig. 12 (1839). — Shell subglobose, conic, imperforate, thin, white, very delicately striate, ornamented with varied lines and interrupted bands; lip simple, acute.

This pretty shell has some points of resemblance with *Helix pisana*, Müll., but is smaller and not umbilicated. The internal edge of the right lip is white instead of rose. The upper surface is covered with numerous yellowish-brown bands, more or less deep, interrupted by oblique lines of same color. Five whorls. Height, 11 mill.; diameter, 15 mill.

Island of St. Thomas; New Orleans. (See L. & Fr.-W. Sh. I. p. 187, Fig. 327.)

Helix Pisana, MÜLLER, United States. — FÉRUSSAC, Tabl. Syst. 119. — GRAY, Turton's Manual. FORBES, Brit. Ass. Rep., 1840, 145. See Bost. Journ., III. 489. This species is not known to exist in America at the present day (1878).

Helix Trumbulli, Linsley, Shells of Conn. (Sill. Journ. [1], XLVIII. 280), = *Skenea serpuloides*. See Vol. IV. 125.

Helix pellucida, Fabricius = *Vitrina Angelicæ.*

Helix arbustorum. See Vol. IV. 124, and Adams, Cat. Cabinet, 32. Does not inhabit America.

Helix hieroglyphica, Beck, Ind. Am. Sept.? See Vol. IV. 124.

Helix domestica, Ström. See *Vitrina Angelicæ.*

Helix dealbata, Say = *Bulimulus.*

Helix corpuloides. See Vol. IV. 124.

Helix Bonplandi, Lamarck. See Vol. IV. 124. Jay, Cat., ed. 2, 33. Tennessee.

Helix haliotoides, Fabricius, Fauna Gröenl., 390 (1780) = *Sigaretus.*

Helix heligmoidea, D'Orb. (*Ophiogyra*), is said to have been found by Mr. H. Moores in 1849, in the Zoot Hills of the west slope of the Sierra Nevada, about five miles south of Coloma, and about a quarter of a mile south of Weber Creek, under an old log; a single old specimen.

The species is described from Guyaquil, Columbia, South America.

Helix virginea, Wood, Ind. Suppl., p. 21, Fig. 19 = *Mélania Virginica.*

Helix urceus, Müller, Dillwyn, Cat., II. 918 = *Ampullaria.*

Helix fuscata, Born, Mus. Vind., 1780, 390, Pl. XVI. Fig. 17. Virginia.

Helix irrorata, Say = *H. lactea*, Müller. See Vol. IV. 124. Does not now exist in America.

Helix rastellum, Beck, Ind., 8. Am. s.

Helix personata, Lamarck, Ohio. Jay, Cat., ed. 2, 36, 1836, and Villa, Disp., 14, 1841.

Helix punctata, Dillwyn, Cat., II. 899, is from Martinique, not Virginia.

Helix ruderata, Studer, Anthony, Ohio Cat., No. 31 = *striatella?*

Helix variabilis, Drap., North America. See Forbes, Brit. Ass. Rep., 1840, 145; see also Bost. Journ. Nat. Hist., III. 489; Férussac, Tabl. Syst., 48.

Helix (*Eurycratera*) *lineolata*, Lam., is erroneously quoted from North America by Beck (Index, 45).

Helix Steenstrupii, Mörch. Greenland. I can find no description of it. *Vide* Vol. IV. 117.

Helix subcarinata, Wood (Index, Suppl., Pl. VII. Fig. 13) = *Leptoxis.*

Helix dissimilis, Wood (Index, Suppl., Pl. VII. Fig. 18) = *Melantho decisa.*

Helix decisa, Wood (Index, Suppl., Pl. VII. Fig. 19) = *Lioplax subcarinata.*

Helix bidentifera, Phillips (Proc. Acad. Nat. Sci. Philad., I. 27, 1841), North Carolina = *H. barbula*, Charp., of Portugal (l. c. p. 133).

Helix palustris, Rackett = *Limnæa palustris.*

Helix angulata, Rackett = *Planorbis bicarinatus.*

Helix albella, Dillwyn, Cat., II. 890. Virginia.

Fossil Species of Helix.

Dr. Meek furnishes the following list of fossil species: —

Helix Leidyi, Hall & Meek, Am. Acad. Arts and Sci., Boston, V. 394, new ser.

Helix amplexus, Meek & Hayden, Proc. Acad. Nat. Sci., Philad., 1861, 431. = *Planorbis amplexus*, M. & H., Proc. Acad. Nat. Sci., Philad., 1857, 135.

Helix spatiosa, M. & H. (*Macrocyclis*) Proc., Acad. Nat. Sci., Philad., 1861, 446.

Helix vitrina, M. & H. (*Macrocyclis*), Proc. Acad. Nat. Sci., Philad., 1861, 447.

Helix Nebrascensis, M. & H. (*Macrocyclis*), Proc. Acad. Nat. Sci., Philad., 1861, 431. = *H. occidentalis*, M. & H. l. c. 1857, 135 (non Recluz, 1845).

Helix vetusta (nom. trans. ob. *H. v.* Mor. & Dr., 1857, J. C. (2), II. 153), M. & H., Proc. Acad. Nat. Sci., Philad., 1860, 431 = *H. vitrinoides*, M. & H., l. c., 1857, 135 (non Deshayes, 1830).

Helix Evansi, M. & H., l. c., 1860, 175.

Helix obliqua, M. & H., l. c., 1857, 134.

Helix strangulata, Adams. See Conrad, Proc. Acad. Nat. Sci., Philad., 1877, 273.

In adopting as generic the groups formerly considered as subgeneric only, the synonymy of the species is in many cases affected. Thus the name *diodonta*, preoccupied in *Helix*, has precedence as a *Mesodon*. I have, however, thought it best to retain the well-established specific name in all cases, to avoid future confusion.

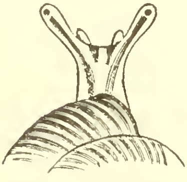
The external generic characters of the animal of the various groups now recognized as genera do not differ. I refer therefore for them to *Patula*, the first genus of dismembered *Helix* included in this work.

STROBILA, Morse.[1]

Animal as in *Patula*.

Shell umbilicated, globose conic or depressed, obliquely and coarsely striated, smoother below; whorls 5 or 6, the last globose; aperture lunately rounded; peristome thickened, reflected; the parietal wall and base of the last whorl each with two or more entering revolving laminæ.

Fig. 149.



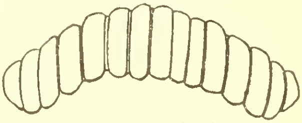
Animal of *S. labyrinthica* (Morse).

An American genus; one of its species, however, is also found in Jamaica.

Jaw low, wide, slightly arcuate, ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with (over twelve in *labyrinthica*, numerous in *Hubbardi*) crowded ribs, denticulating either margin, and more developed on the centre of the jaw.

Lingual membrane of *labyrinthica* as usual in *Helicea*, long and narrow, with 78 rows of 13—1—13 teeth each, with 5 perfect laterals. Morse figures 6 laterals. Centrals with a base of attachment about square, upper edge broadly reflected; reflection very short, bearing a long, slender, median cusp reaching the lower edge of the base of attachment, with a short cutting point extending slightly beyond it; side cusps very small, each bearing a short cutting point.

Fig. 150.



Jaw of *S. labyrinthica*.

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[1] Journal Portland Society Nat. Hist., I. 26 (1864).

Lateral teeth like the centrals, but asymmetrical by the suppression of the inner lower angle of the base of attachment, and the inner side cusp and side cutting point. Outer laterals gradually changing into the marginals, which are low, wide, with a reflection equalling the base of attachment, and furnished with numerous (about five) subequal, short cutting points, the inner one longest and bifid (Pl. V. Fig. O).

Morse mentions no ribs on the anterior surface of the jaw, but they are well developed on the specimen examined by me.

S. Hubbardi, a specimen from Bonaventure Cemetery near Savannah, kindly opened by Mr. Bland, furnished a jaw and lingual membrane. Jaw long, low, slightly arcuate, ends acuminated; no median projection to cutting edge; anterior surface with numerous crowded ribs, denticulating either margin. Lingual membrane with 14—1—14 teeth, 5 laterals. All the teeth like those of *S. labyrinthica* (Pl. V. Fig. N).

There are no known species foreign to North America, with which to compare the dentition and jaw of *labyrinthica* and *Hubbardi.*

Strobila labyrinthica, Say.

Vol. III. Pl. XVII. Fig. 3.

Shell umbilicated, globose-conic, brownish horn-color, with stout ribs above, and below lighter with arborescent wrinkles; spire obtuse; umbilicus narrow, pervious; aperture scarcely oblique, lunately rounded; peristome briefly reflected, thickened; parietal wall with three revolving, deeply entering, parallel laminæ, the central further within the aperture and less developed, and around the axis one stout lamella-like rib not reaching the columella; on the base of the outer whorl are two short, deeply seated internal revolving rib-like laminæ. Greater diameter, $2\frac{1}{2}$ mill.; height, $1\frac{2}{3}$ mill.

Helix labyrinthica, Say, Journ. Phila. Acad., I. 124 (1817); Nich. Encycl., ed. 3, IV. (1819); ed. Binney, 10. — Binney, Bost. Journ. Nat. Hist., III. 393, Pl. XXVI. Fig. 1 (1837); Terr. Moll., II. 202, Pl. XVII. Fig. 3. — Gould, Invertebrata, 184, Fig. 106 (1841). — Adams, Vermont Mollusca, 160 (1842). — Férussac, Tab. Syst., 38; Hist., Pl. LI. B, Fig. 1. — Pfeiffer, Symbolæ, II. 31; Mon. Hel. Viv., I. 416. — Chemnitz, 2d ed. I. 382, t. LXVI. Figs. 17-20. — Reeve, Con. Icon., No. 728 (1852). — DeKay, N. Y. Moll., 39, Pl. III. Fig. 31 (1842). — Deshayes in Fér., I. 210. — W. G. Binney, Terr. Moll., IV. 95; L. & Fr.-W. Sh., I. 84 (1869). — Morse, Amer. Nat., I. 545, Figs. 41, 42 (1867). — Gould and Binney, Inv. of Mass., ed. 2, 415 (1870).

Strobila labyrinthica, Morse, Journ. Portl. Soc., I. 26, Figs. 64-67, Pl. II. Fig. 12, a, b; Pl. VIII. Fig. 68 (1864). — Tryon, Am. Journ. Conch., II. 259 (1866).

A post-Pleiocene[1] species, now found over all of the Eastern Province. It may perhaps, also, have been noticed in Mexico under the name of *H. Strebeli*, Pfr. (see Fischer and Crosse, Moll. Mex. et Guat.).

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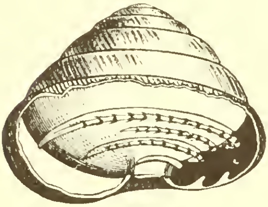
[1] Woodward (Man. 384) refers an extinct English Eocene *Helix* to this species. I have seen no specimens of it. Mr. Bland writes me that he has received from France a fossil shell under the name of *H. labyrinthicula*, apparently identical with our species.

Whiteaves (Can. Nat., VIII. 56) says *H. labyrinthica* has been found in Upper Eocene at Headon Hill, Isle of Wight, and in the Paris basin.

Mr. Morse has lately given the following description of the internal laminæ which characterize this species: —

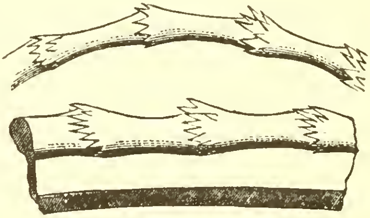
"The shell has been described as having one revolving tooth within the aperture, and sometimes a second one terminating farther within the aperture. I have always found this second one constant, and also a *third* one, but slightly raised between these two. At the base of the shell and far within the aperture are two more revolving ribs, running about a third of one volution. These are plainly visible through the substance of the shell. A heavy columellar tooth or rib extends from a slight distance within the aperture, nearly one volution back. This columellar tooth thickens the substance of the shell in the umbilical region, and causes a distinct fold without the shell. A most singular feature is revealed in the structure of the parietal laminæ. With an ordinary magnifying power, small swellings are seen at close intervals along these laminæ, which, when magnified four hundred diameters, are seen to be surmounted with from five to ten sharp spines pointing towards the aperture. These swellings appear to coincide in number and position with the raised ribs without the shell, though they are not formed at the same time; for as these laminæ approach the aperture they become attenuated and disappear. The surface upon which these laminæ rest is granulated, and not smooth, as is generally the case with the interior of shells. It is difficult to imagine the use of these spiny projections, unless they may act in some way as points of resistance to the animal for the support of a very heavy shell."

Fig 151.



S. labyrinthica, enlarged.

Fig. 152.



Parietal laminæ of *S. labyrinthica*.

Jaw (see p. 258).

Lingual membrane with 78 rows of 13—1—13 teeth each; centrals tricuspid, central cusp very long; laterals of same shape, but bicuspid; marginals low, broad, serrated. (Pl. V. Fig. O.)

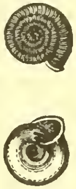
Strobila Hubbardi, Brown.

Shell umbilicated, depressed, thin, obliquely striated above, smooth below, reddish horn-color; whorls 4½ – 5, convex, regularly increasing, the last but slightly descending; umbilicus wide; aperture quite oblique, subcircular;

peristome thickened, somewhat reflected, white, not covering the umbilicus; internal laminæ four, two upon the parietal wall of the aperture, of which the upper one is much more developed than the lower; the two remaining ones placed deep within the last whorl on its base. Greater diameter, 2½ mill.; height, 1¼ mill.

Helix Hubbardi, A. D. Brown, Proc. Acad. Nat. Sci. Philad., 1861, 333. — W. G. Binney, L. & Fr.-W. Sh., I. 86 (1869).
Strobila Hubbardi, Tryon, Am. Journ. Conch., II. 259 (1866).
Helix Vendryesiana, Gloyne, Journ. de Conch., XI. 333, 1871.

Fig. 153.



S. Hubbardi, enlarged.

Found near Indianola, Calhoun County, Texas, Bonaventure Cemetery, near Savannah, Georgia. It thus must have a wide range over the Southern Region. It was subsequently discovered at Bellevue, in the Parish of St. Andrew, Island of Jamaica, and described as *H. Vendryesiana*. Gloyne mentions the parietal lamella only, but there are others as described by Brown. The species is, in fact, allied to *S. labyrinthica*, Say, and not to *Polygyra paludosa*, to which group it is referred by Gloyne.

The distribution of *S. Hubbardi* is certainly curious, but it may be observed that *S. Strebeli*, Pfr., which is extremely like, if not identical with, *labyrinthica*, belongs to the Mexican fauna.

For jaw and lingual dentition (Pl. V. Fig. N), see p. 258.

Genitalia not observed.

GONOSTOMA, Held.

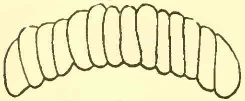
Animal as in *Patula*.

Shell umbilicated, orbicularly depressed, arctispiral, often lightly hirsute; whorls 5 – 7, gradually increasing, the last angular or acutely carinated above; aperture oblique, narrow, lunate, quite often sinuous; peristome reflected, thickened, often heavy; parietal wall without tooth-like processes.

A European and Mediterranean genus, found also in the Canaries and at Teneriffe. In North America it is only represented in the California Region, and by one species only.

Von Martens describes the jaw of *Gonostoma* as having distinct ribs. Moquin-Tandon so figures that of *obvoluta*, Müll., *lenticula*, Fér., and *Rangiana*, Fér; and Gassies (Journ. de Conch., XV. 1867, 15) so describes that of *H. constricta*, B. Our single species has a jaw (Fig. 154) low, wide, slightly arcuate, ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with a strong transverse line of reinforcement, and numerous (about twelve) wide, crowded ribs denticulating either margin.

Fig. 154.



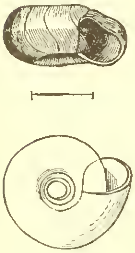
Jaw of *G. Yatesi.*

The lingual membrane of *obvoluta* is described by Goldfuss (l. c. 45) with a type of central teeth differing from that I have shown in *Yatesi*. This last has its lingual membrane (Pl. V. Fig. Q) long and narrow; teeth 24—1—24, with 6 perfect laterals. Centrals with the base of attachment longer than wide, with expanding lower lateral angles, and squarely reflected upper margin; reflection large, stout, bearing small but distinct side cusps, with short, blunt cutting points, and a long, stout median cusp reaching the lower edge of the base of attachment, beyond which projects the long, acute cutting point. Laterals like the centrals, but asymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the distinct inner side cusp and cutting point. Marginals subquadrate (*b*), a simple modification of the laterals, the reflection being more developed, and bearing one inner, oblique, long, blunt cutting point, and one smaller side cutting point; the extreme marginals (*c*) are rather wider than high, and the cutting points are bluntly rounded.

Gonostoma Yatesi, J. G. Cooper.

Shell globosely planulate, equally depressed above and below, widely umbilicated, thick, smooth, scarcely marked with incremental striæ, horn-colored; spire sunken, apex obtuse; whorls $6\frac{1}{2}$, slightly convex, each one raised above the preceding one, the last tumid, obsoletely carinated, descending at the aperture; aperture oblique, lateral; peristome thickened, white, its extremities far removed, scarcely reflected, above deflected and sinuous; umbilicus very wide, showing all the whorls. Greater diameter 9, lesser 7 mill.; height, 4 mill.

Fig. 155.



G. Yatesi.

Ammonitella Yatesii, J. G. Cooper, Am. Journ. Conch., IV. 209, Pl. XVIII. Fig. 1 – 14, figure reversed (1869).

In the California Region, in Calaveras County, California, at Cave City.

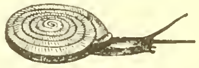
Jaw and lingual membrane: see above p. 261 (Pl. V. Fig. Q).
Genitalia unobserved.

POLYGYRA, Say.

Animal heliciform; mantle posterior; other characters as in *Patula*.

Shell umbilicated or perforated, orbicularly flattened, obliquely and costulately striate; whorls 5 – $7\frac{1}{2}$, gradually increasing, the last anteriorly constricted, briefly deflected, inflated below, devious, the penultimate whorl plainly conspicuous, very often constricting the rimate umbilicus; aperture subreniform, or irregularly sinuate; peristome narrowly reflected, heavy, its margins usually dentate and joined by a triangular, dentiform callus, obliquely entering on the parietal wall of the aperture.

Fig. 156.

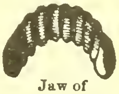


Animal of *P. septemvolva*.

Interior and Southern Region, especially the latter in North America. It is also represented in the West Indian Islands, in Mexico and Yucatan, and one species is found in Bolivia.

Jaw high, arcuate, ends scarcely attenuated, blunt, cutting edge without median projection; anterior surface with numerous stout, separated ribs, denticulating either margin. I have counted 8 ribs in *P. ventrosula;* 14 in *pustula;* 10 in *auriculata;* 12 in *Postelliana;* 12 in *Carpenteriana;* 10 in *pustuloides;* 12 in *avara;* over 14 in *cereolus;* 10 in *espiloca;* 13 in *uvulifera;* 10 in *Texasiana* and *triodontoides;* 12 in *Troostiana;* 11 in *leporina;* 15 in *Mooreana;* 20 in *fastigans;* 7 in *septemvolva;* 10 in *Febigeri;* in *Hazardi* and *auriformis* they are also numerous. I have had no opportunity of examining the jaw in the other species found within our limits *Hindsi, tholus, hippocrepis, oppilata, Dorfeuilliana, Ariadnæ.*

Fig. 157.

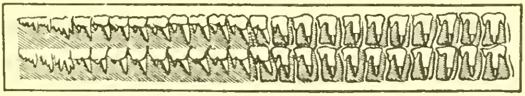


Jaw of *S. ventrosula.*

By the character of its jaw, *Polygyra* can be compared only to *Triodopsis* and *Mesodon* among the other North American subgenera of *Helix.* No foreign species has yet been examined.

Fig. 158 shows the general arrangement of the teeth upon the lingual membrane, the characters of the individual teeth being better shown in my Pl. VI.

Fig. 158.



Lingual dentition of *P. auriformis?* (Leidy).

The teeth do not differ from what I have described under *Stenotrema* (see below). As in all the subgenera, there is considerable difference in the length of the base of attachment on the central and lateral teeth in the several species.

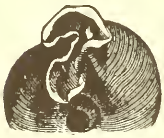
I find considerable difference between the various species in the manner in which the lateral teeth pass into the marginals. In *auriformis, Postelliana, espiloca,* and *Hazardi,* the change is made simply by the greater development of the inner cutting point, not by its bifurcation (see Pl. VI. Fig. N). In these species it is only the extreme outer marginals that have their inner cutting point bifid; in *auriformis* a very few extreme marginals have a bifid cutting point. This species has very long inner cutting points to its marginal teeth. In the other species examined by me the first marginals have their inner cutting point bifid, the transition from laterals to marginals being thus very distinctly marked (see Pl. VI. Fig. K). With these exceptions, the dentition of our species of *Polygyra* is very like that of *Stenotrema* (q. v.).

The dentition of no foreign species is known with which to compare our species.

Polygyra auriculata, Say.

Shell rimately perforated, flattened above, inflated below, with rib-like striæ, reddish horn-color or brownish; whorls 5½, narrow, the last deflected at the aperture, disjoined, constricted and scrobiculated below; umbilicus level, showing only the penultimate whorl; aperture sub-horizontal, ear-shaped, ringent, almost closed; peristome continuous, its terminations joined by an oblong, entering, excavated fold, the right margin furnished within with a deep lamellar fold, and forming a subacute angle with the basal margin, on which is one broad tubercle. Greater diameter 16, lesser 13 mill.; height, $7\frac{1}{2}$ mill.

Fig. 159.



P. auriculata, enlarged.

Polygyra auriculata, SAY, Nich. Encycl., 3d Am. ed. (1819); Journ. Phil. Acad., I. 277 (1818); BINNEY'S ed., 10.

Helix auriculata, FÉRUSSAC, Hist., Pl. L. Fig. 4 (1822). — BINNEY, Bost. Journ. Nat. Hist., III. 384 (ex parte), Pl. XIX. Fig. 1 (1840), excl. syn.; Terr. Moll., II. 186, Pl. XL. Fig. 1 (left hand). — LEIDY, T. M. U. S., I. 255, Pl. IX. Figs. 5, 6 (1851), anat. — DEKAY, N. Y. Moll., 47, Pl. III. Fig. 28 (1843). — PFEIFFER, Mon. Hel. Viv., I. 417; IV. 318, excl. var. (1853). — CHEMNITZ, ed. II. 371, t. lxv. Figs. 3, 4. — DESHAYES in FÉR. Hist., 76 (excl. var.), Pl. I. Fig. 4; in LAM., VIII. 112; ed. 3, III. 308. — REEVE, Con. Icon., No. 700, excl. Fig. (1852). — BLAND Ann. N. Y. Lyc., VII. 26, Fig. (1858). — W. G. BINNEY, Terr. Moll., IV. 73; L. & Fr. W. Sh., I. 87 (1869).

Dædalochila auriculata, TRYON, Am. Journ. Conch., III. 157 (1867).

St. Augustine, Enterprise, Lake George, and Indian River, Florida. It is confined to the Florida Subregion.

Animal longer than the breadth of the shell, acute behind, above granulated and blackish, beneath and each side white; eye-peduncles long, slender, and tapering; tentacles short, and of nearly equal diameter. Shell carried as in *P. septemvolva*.

P. auriculata may be distinguished from the allied species by its larger size, the greater development of the several parts of its curious aperture, and especially by the sudden outward deflexure of the central part of the labrum, which has a deep scrobiculation behind it, corresponding with the upper tooth within the aperture. The portion of the labium extending from the inferior angle of the parietal intruded tooth is erect, and more elevated than in any other of the species.

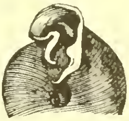
Jaw as usual in the subgenus; ten ribs. There are 26—1—26 teeth on the lingual membrane. The inner cutting point of the thirteenth tooth is bifid, so that there are 12 laterals. Pl. VI. Fig. A.

The genitalia are figured by Leidy (l. c.). The St. Augustine form examined by me has a similar arrangement of the organs. I doubt not, therefore, that Leidy's figure was drawn from the true *auriculata*. The penis sac is long, tapering above, where it receives both vas deferens and retractor muscle; the genital bladder is elongate ovate, on a short, narrow duct.

Polygyra uvulifera, SHUTTLEWORTH.

Shell rimately perforated, flat above, inflated below, striated, reddish horn-color or brownish, rather solid, shining; whorls 5, slowly increasing, narrow, the last abruptly deflected at the aperture, devious below, constricted and scrobiculated; aperture very oblique, ear-shaped, ringent, very much narrowed; peristome acute, patulously reflected, its terminations joined by an oblong, tongue-shaped, deeply entering, excavated fold, its right margin with a deeply seated lamella terminating in a reflected, filiform uvula-like point, the basal margin with an oblique, sinuous, tooth-like tubercle. Greater diameter 12, lesser 11 mill.; height, 7 mill.

Fig. 160.



P. uvulifera, enlarged.

Helix uvulifera, Shuttleworth, Bern. Mitt., 1852, 199. — Chemnitz, ed. 2, II. 420, Pl. CXLVIII. Figs. 19, 20 (1853). — Gould, Terr. Moll., III. 20. — W. G. Binney, Terr. Moll., IV. 75; L. & Fr.-W. Sh., I. 87 (1869). — Pfeiffer, Mon. Hel. Viv., III. 267. — Bland, Ann. N. Y. Lyc. N. H., VII. 34, Fig. 13 (1858).

Helix florulifera, Reeve, Con. Icon., No. 699 (Aug. 1852).

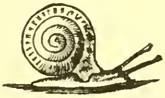
Helix auriculata, minor, Férussac, Hist., Pl. I. Fig. 3? (teste Pfeiffer).

Dædalochila uvulifera, Tryon, Am. Journ. Conch., III. 157 (1867).

Found plentifully on the Florida Keys, Key West, Little Sarazota Bay, Long Key, Florida, Dallas, and at Cape Sable. As I also have specimens from Corpus Christi, it probably inhabits the whole Gulf coast of the Southern Region.

P. uvulifera may be distinguished from *P. auriculata* by the character of the peristome, which is equally produced from the superior angle of the parietal process, to the base of the inferior tooth or fold, where it is reflected, sometimes appressed to the last whorl. The lower angle of the parietal process is connected with the inner termination of the peristome by a flat, more or less developed callus. The umbilical region is less open, and there is no groove within it on the last whorl.

Fig. 161.



Animal of *P. uvulifera*.

Jaw low, arcuate, ends blunt, anterior surface with about 13 ribs, denticulating either margin.

Lingual membrane (Pl. VI. Fig. B) with 23—1—23 teeth. There are about 8 perfect laterals.

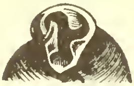
Genitalia as in *P. auriculata*.

Polygyra auriformis, Bland.

Shell rimately perforate, above depressed, with rib-like striæ, beneath inflated, convex, almost smooth, and with microscopic spiral lines; white, or brown horn-color, thin; spire very short; whorls 5½ – 6, rather flat, the last deflected, and shortly turned outwards from the preceding whorl, constricted, scarcely scrobiculate; aperture sub-horizontal, ear-shaped, contracted; peristome acute, continuous, the margins joined by a short linguiform fold, entering within the aperture; the right margin with an obtuse submarginal lamella, and the base with an oblique, sinuous, tooth-like fold. Greater diameter 11½, lesser 10 mill.; height, 6 mill.

Helix auriformis, Bland, Ann. N. Y. Lyc., VII. 37, Fig. (1858). — W. G. Binney, L. & Fr.-W. Sh., I. 88 (1869).

Fig. 162.



P. auriformis, enlarged.

Helix auriculata, Binney, Bost. Journ. Nat. Hist. (ex parte), Pl. XIX. Fig. 2 (1840); Terr. Moll., II. 186 (ex parte), Pl. XL. Fig. 1 (right hand), 2. — Reeve, Con. Icon., 700. — Deshayes in Fér., Hist., var. *minor*, Pl. L. Fig. 3.

Helix avara, Chemnitz, ed. 2, 370 (ex parte), T. LXV. Figs. 1–2. — Pfeiffer, Mon. Hel. Viv., I. 418. — Reeve, Con. Icon. 720.

? *Helix Sayii*, Wood, Ind. Suppl., Pl. VII. Fig. 34; ed. Hanley, 228, Fig. 34. — DeKay, N. Y. Moll., 47.

Dædalochila auriformis, Tryon, Am. Journ. Conch., III. 155 (1867).

Inhabits the Southern Region. From Texas to Georgia it is an extremely common species. Immense beds of semi-fossil specimens are found in middle Alabama.

This species is common in American cabinets, and usually labelled *P. avara*, or var. of *P. auriculata*, but it appears entirely distinct. It is most nearly allied to the former, but is larger, not hirsute, and has the groove in the last whorl within the umbilical region like the latter. The parietal fold is somewhat similar to, but does not descend so far into the aperture as that of *P. Postelliana*, but the teeth on the labrum are in form and position, though more developed, rather like those of *P. avara*. They are separated by the same deep sinus, but the upper one generally without the sharp reflexed hook at its termination.

Jaw as usual in the genus; ribs numerous.

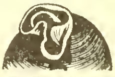
The lingual membrane (Pl. VI. Fig. R) has 26—1—26 teeth, with 8 laterals. Fig. *c* shows the proportional greater development of the cutting point in the outer laterals. The change from laterals to marginals is not formed by the splitting of the inner cutting point, which remains simple to the extreme outer margin. This peculiarity is shared by *Postelliana*, *espiloca*, and *Hazardi*.

Genitalia unobserved.

Polygyra Postelliana, Bland.

Shell rimately perforate, above slightly convex, with rib-like striæ wider apart and more prominent behind the aperture; beneath inflated, convex, almost smooth, and with microscopic spiral lines; brown horn-color, thin, shining, subpellucid; whorls 5, gradually increasing, rather convex, the last deflected and turned outwards from the preceding one, scrobiculate, constricted, grooved within the umbilical region; suture impressed; aperture oblique, ear-shaped, contracted; peristome white, acute, continuous, the margins joined by a tongue-shaped fold, excavated above, entering into the aperture, the right margin having a deeply seated lamella, which terminates in a reflexed hook, the base with an erect lamelliform, scarcely oblique tooth, produced into and recurved within the aperture. Greater diameter $9\frac{1}{2}$, lesser $8\frac{1}{2}$ mill.; height, 5 mill.

Fig. 163.



P. Postelliana, enlarged (Bland).

Helix Postelliana, Bland, Ann. N. Y. Lyc., VI. 35, Fig. (1858). — W. G Binney, L. & Fr.-W. Sh., I. 89 (1869).
Dædalochila Postelliana, Tryon, Am. Journ. Conch., III. 156 (1867).

Georgia, in Wayne County, and on the sea islands of Georgia and South Carolina; Baldwin, Florida. Not noticed out of the Southern Region, and probably a species of the Florida Subregion.

It is smaller than *auriculata*, and the rib-like striæ which cover the whole of that shell are scarcely developed at the base. The form of the parietal process is very like that of *uvulifera*, but the continuation of its inferior angle to the inner termination of the peristome is not prostrate, as in that species, but erect, as in *auriculata*. The position and form of the upper tooth on the peristome is much the same as in that species and in *uvulifera*, but the lower one is entirely different. In those it is an oblique, strongly developed, convex, sinuous fold on the margin of the peristome, not descending into the aperture, there being within a slight thickening only, corresponding with the lower exterior apertural depression. In *Postelliana* there is at the base of the peristome a thin, erect, oblong, lamelliform tooth, rather oblique, but more closely marginal than the fold in the other species. The exterior of this tooth is convex, within concave; it is 1 mill. in height, and 1½ in length, and descends rapidly into the aperture, where it is recurved, and terminates obtusely opposite to the lower end of the superior tooth, there being a very distinct and tortuous sinus between the two. In opening specimens from different localities, these characters are found to be constant.

Jaw, as usual in the genus, with over 12 ribs.

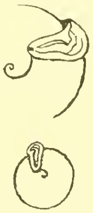
Lingual membrane with 21—1—21 teeth. The marginals, as in *auriformis* (q. v.), have their inner cutting point simple, not bifid, even the very last at the outer edge. (Pl. VI. Fig. N.)

Genitalia as in *P. auriculata*.

Polygyra espiloca, Ravenel.

Shell rimately perforate, above slightly convex, beneath convex, striated, reddish horn-color, thin, with very short hairs; spire scarcely elevated; whorls 5, rather convex, the last deflected and turned outwards from the preceding one, scrobiculate, constricted, grooved within the umbilical region; aperture very oblique, subreniform, contracted; peristome acute, continuous, the margins joined by a lamella, excavated above, and produced into a tongue-shaped tooth; the right margin having a broad hooked lamella, and the base an erect lamelliform tooth produced into and recurved within the aperture. Greater diameter 9, lesser 8 mill.; height, 4 mill.

Fig. 164.



P. espiloca.

Helix espiloca, Ravenel, MS., Bland, Ann. N. Y. Lyc., VII. 115, Pl. IV. Figs. 1, 2. — W. G. Binney, L. & Fr.-W. Sh., II. 91 (1869).
Dædalochila espiloca, Tryon, Am. Journ. Conch., III. 156 (1867).

Sullivan's Island, South Carolina; St. Simon's Island, Georgia; Indianola, Texas; New Orleans. It seems, therefore, to range over the Southern Region.

In the form of the parietal process it is intermediate between *P. Postelliana* and *P. avara*, but most like the latter; the teeth on the peristome are very similar to those in the former, but beneath it is less inflated, the umbilical region is wider, showing more of the penultimate whorl, and it is hirsute.

Jaw as usual in the genus; 10 ribs.

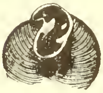
Lingual membrane (Pl. VI. Fig. P) with 25—1—25 teeth, with 11 laterals. The inner cutting point of the marginals is simple, not bifid.

Genitalia not observed.

Polygyra avara, Say.

Shell rimately umbilicated, depressed-convex above, convex below, striated, especially near the aperture, horn-colored, thin, covered with numerous short, robust hairs; spire convex, not much elevated; whorls 4, rounded, the last more convex, constricted behind the peristome, not grooved within the moderate umbilicus; aperture very oblique, subreniform, contracted; peristome white, acute, elevated, continuous, its terminations connected by an elevated, oblique angular fold; the columellar margin furnished with two projecting, obtuse, curved teeth, separated by a deep sinus. Greater diameter 7, lesser 6 mill.; height, 3 mill.

Fig. 165.[1]



P. avara, enlarged.

Polygyra avara, Say, Nich. Encycl., 3d Am. ed (1819); Journ. Phila. Acad., I. 277 (1818), ed. Binney, 11. — DeKay, N. Y. Moll., 47 (1843).

Helix avara, Férussac, Hist., Pl. L. Fig. 2. — Pfeiffer, var. β *minor*, Mon. Hel. Viv., I. 418 (ex parte). — Deshayes in Fér. Hist., II. 78, Pl. L. Fig. 2. — Chemnitz, ed. II. 370 (ex parte), excl. Fig. — Reeve, Con. Icon (ex parte), No. 720, excl. Fig. — Bland, Ann. N. Y. Lyc., VII. 30, Fig (1858). — W. G. Binney, Terr. Moll., IV. 74; L. & Fr.-W. Sh., I. 91 (1869).

Dædalochila avara, Tryon, Am. Journ. Conch., III. 155 (1867).

St. John's River, Florida, "in Mr. Fatio's orange-grove" (Say). The locality is near Remington Landing.

P. avara, Say, may be readily distinguished by its smaller size, more delicate texture, and less globose form; it has from 4 to 4½ whorls, and is the only species of the group which is hirsute, except *P. espiloca*. The superior tooth on the peristome is armed with a hook, as in the other species, but is narrower, less deeply seated, and more erect; the inferior one is rather a distinct tooth than a lamellar fold. The parietal process differs entirely from that of *P. auriculata*, as plainly shown in the figure. *P. avara* is without the groove on the last whorl, which prevails in *auriculata*, and the forms represented by Dr. Binney as varieties of it. It is very rare in collections: I know of but two specimens of it.

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[1] The *striæ* in Fig. 165 are incorrectly represented: they should have been shown only at the termination of the last whorl, over a small space immediately behind the peristome.

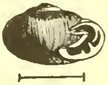
Jaw with over 12 ribs.

Lingual membrane as usual in the genus; teeth 17—1—17, with 8 laterals. (Pl. XV. Fig. L.)

Polygyra ventrosula, Pfeiffer.

Shell rimately perforated, globosely depressed, thin and shining, pellucid, delicately striated, horn-colored; spire slightly raised; whorls 5, but little convex, the last one subangulated above, falling suddenly towards the aperture, inflated below, anteriorly gibbous and contracted; aperture very oblique, ringent; peristome acute, broadly reflected, its terminations scarcely approaching each other, but joined by two white, elevated laminæ, which are placed at acute angles on the parietal wall; the basal margin is also furnished with two white acute denticles; on the right margin is placed a white sub-perpendicular, extended lamina. Greater diameter 13, lesser 11 mill.; height, 7½ mill.

Fig. 166.



P. ventrosula.

Helix ventrosula, Pfeiffer, Proc. Zoöl. Soc. 1845, 131; Mon. Hel. Viv., I. 417; in Chemnitz, ed. 2, I. 373 (1846), Pl. LXV. Figs. 5, 6 (1849). — Reeve, Con. Icon., No. 687 (1852). — W. G. Binney, Terr. Moll., IV. 73, Pl. LXXVII. Fig. 14; L. & Fr.-W. Sh., I. 92, Fig. 164 (1869). — Crosse and Fischer, Moll. Mex. et Guat. 274 (1870).

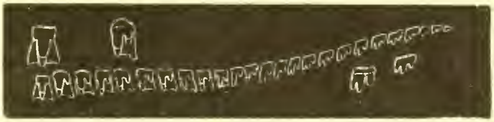
Dædalochila ventrosula, Tryon, Am. Journ. Conch., III. 63 (1867).

A Mexican species, found also in the Texas Subregion.

Jaw strongly arcuate, of uniform width, ends blunt, anterior surface with 8 broad ribs, crenulating both margins (see Fig. 157, p. 263).

Lingual membrane with 93 rows of 24—1—24 teeth each, 9 laterals; centrals tricuspid, the side cusps very small; laterals of same shape, but bicuspid; marginals with one inner, oblique, bluntly bifid cutting point, and one smaller outer cutting point.

Fig. 167.

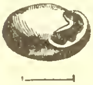


Lingual dentition of *P. ventrosula.*

Polygyra Hindsi, Pfeiffer.

Shell narrowly umbilicated, depressed, delicately striate, brownish horn-color, diaphanous, thin, shining; spire slightly elevated; whorls 5, flattened, the last deflected at the aperture, more convex and constricted below; umbilicus pervious; aperture very oblique, lunate, ringent; peristome slightly reflected, its terminations converging, joined by a triangular, tooth-like, two-forked callus, the right-hand margin with one subvertical lamina, the columellar margin with two acute denticles. Greater diameter 8, lesser 7 mill.; height, 4½ mill.

Fig. 168.



P. Hindsi.

Helix Hindsi, Pfeiffer, in Proc. Zoöl. Soc. 1845, 132; Mon. Hel. Viv., I. 416; in Chemnitz, 2d ed., I. 373, Tab. LXV. Figs. 7, 8. — Reeve, Con. Icon., 712 (1852). — Gould, in Terr. Moll., III. 17. — W. G. Binney, Ter. Moll., IV. 92, Pl. LXXVIII. Figs. 5, 6, 8. — L. & Fr.-W. Sh., 93, Fig. 167 (1869). — Fischer and Crosse, Moll. Mex. et Guat., 273 (1876).

Dœdalochila Hindsi, Tryon, Am. Journ. Conch., III. 63 (1867).

In the Texan Subregion in Texas and Mexico.

Animal not observed.

Polygyra Texasiana, Moricand.

Vol. III. Pl. XLV Fig. 1.

Shell rimately perforated, depressed, orbicular, rather solid, of a pale horn-color, sometimes with a revolving rufous band, with crowded rib-striæ above, smooth, or faintly striated, and shining beneath; spire nearly flat, of 5 whorls separated by a well-marked suture, the outer one obtusely angular at periphery, nearly at the plane of the spire, and somewhat deflected near the aperture; beneath convexly rounded, with a somewhat distorted appearance in consequence of the whorl becoming narrower, rather than broader, towards the aperture, leaving a minute umbilical perforation; aperture very oblique, narrow lunate, the peristome forming about two thirds of a circle, reflected, white, with a constriction behind it, and armed with two denticles at its inner margin, one near the centre, the other at the middle of the basal portion; the extremities of the peristome connected by a callus across the columella, of an acutely angular form, pointing to the middle of the portion of the peristome above the upper denticle, the lower ramus of the angle being longest and largest, and a little concave inwardly. Greater diameter 10, lesser 8½ mill.; height, 5 mill.

Helix Texasiana, Moricand, Mem. Soc. Phys. Hist. Nat. de Géneve, VI. 538, Pl. I. Fig. 2 (1833). — Deshayes in Lamarck, VIII. 133; ed. 3, III. 316; in Fér. I. 74, Pl. 1. c (excl. syn.). — Férussac, Hist. des Moll., Pl. LXIX. D. Fig. 2. — Pfeiffer, Mon. Hel. Viv., I. 418, excl. syn. and var. β; Vol. IV. 318. — Chemnitz, ed. 2 (1846), I. 85, excl. var. and figure. — Reeve, Con. Icon., No. 707. — Binney, Terr. Moll., II. 191, Pl. XLV. Fig. 1. — W. G. Binney, Terr. Moll., IV. 79. — L. & Fr.-W. Sh., I. 93 (1869). — Fischer and Crosse, Moll. Mex. et Guat., 279 (1870).

Helix auriculata, Binney, Bost. Journ. Nat. Hist., III. 387.

Helix Tamaulipasensis, Lea, Proc. Acad. Nat. Sci. Phila. 1857, 102; Journ. —; Obs. XI. 139, Pl. XXIV. Fig. 113.

Dædalochila Texasiana, Tryon, Am. Journ. Conch., III. 62 (1867).

In the Texan Subregion in Texas and the neighboring Mexican State of Tamaulipas.

Animal brownish, or dingy white; eye-peduncles darker, sheaths visible by a dark line, much enlarged at tip.

There is a variety larger, with 6 whorls, and with a brown band revolving above the periphery.

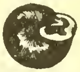
Jaw wide, low, slightly arcuate, ends blunt, with 10 decided ribs, denticulating either margin.

Lingual membrane, as usual in the genus. Teeth 26—1—26, with 11 laterals. (Pl. VI. Fig. G.)

Polygyra triodontoides, BLAND.

Shell umbilicated, globose-depressed, thin, subpellucid, pale horn-colored, with partially obsolete rib-like striæ above; base convex, smooth; spire short; whorls 5, somewhat convex, the last plicately ribbed near the aperture, deflexed anteriorly; aperture roundly lunate, oblique, contracted; peristome reflected, callous, the margins joined by a sharp linguiform triangular tooth, the right with a tooth on the margin of the callus, basal with an oblique tooth, both teeth small and far apart. Greater diameter 9½, lesser 8 mill.; height, 5 mill.

Fig. 169.



P. triodontoides.

Helix triodontoides, BLAND, Ann. N. Y. Lyc., VII. 424, Pl. IV. Figs. 11, 12 (1861). — W. G. BINNEY, L. & Fr.-W. Sh., I. 94 (1869).
Helix Texasiana, W. G. BINNEY, Terr. Moll., IV. 79, Pl. LXXVIII. Fig. 18.
Dædalochila triodontoides, TRYON, Am. Journ. Conch., III. 62 (1867).

Corpus Christi and De Witt County, Texas, belonging, therefore, to the Texan Subregion; but I have traced it northward into the Indian Territory (Choctaw Nation).

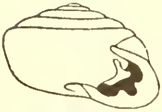
P. triodontoides is a more delicate shell than *P. Texasiana*, and does not attain the same size. It is not as distinctly ribbed, is somewhat more elevated, and the aperture more round. The last whorl is less devious at its termination beneath, the peristome teeth are smaller and wide apart. In *P. Texasiana* they are close together, and the space between them has much resemblance to the notch in *Stenotrema hirsutum*. In that respect, as well as in the form of the aperture, Moricand's shell is more closely allied to *P. Mooreana*, W. G. Binn.

Lingual membrane as in *fastigans*, *cereolus*, etc.

Polygyra Mooreana, W. G. BINN.

Shell umbilicated, orbicular, globose, white, subcarinated; spire more or less depressed, obtusely rounded; whorls 6, distinctly striated, hardly convex; suture impressed; below the carina the body-whorl is not rounded, but slants down to the base, which is parallel with the suture; below, the striæ are less distinct; at the umbilical region only one and a quarter whorl is visible, the outer one strongly carinated so as to conceal a portion of the umbilicus and a great part of the remaining whorl; the umbilicus is very small, but perforates the shell to the apex, showing all the volutions with the aid of a lens; aperture rounded, contracted by three teeth; peristome heavy, broad, white, hardly reflected, near the basal extremity, quite on the edge, armed with two short, incurving teeth, separated by a small, rounded sinus; on the columella there is a tooth-like fold, square, projecting across the aperture, its extremities joining those of the peristome; an internal transverse tubercle on the base of the shell. Greater diameter 8½, lesser 7 mill.; height, 3 mill.

Fig. 170.



P. Mooreana, enlarged.

Helix Mooreana, W. G. Binney, Proc. Acad. Nat. Sci. Philad., 1857, 184; Terr. Moll., IV. 80, Pl. LXXVIII. Fig. 24; L. & Fr.-W. Sh., I. 95 (1869). —Fischer and Crosse, Moll. Mex. et Guat., 275 (1870).—Pfeiffer, Mon. Hel. Viv., IV. 52.

Dædalochila Mooreana, Tryon, Am. Journ. Conch., III. 64 (1867).

Helix tholus, W. G. Binney, Proc. Acad. Nat. Sci. Philad., 1857, 186; Terr. Moll., IV. 81, Pl. LXXVII. Fig. 21; L. & Fr.-W. Sh., l. c. 95. —Pfeiffer, Mon. Hel. Viv., IV. 351.

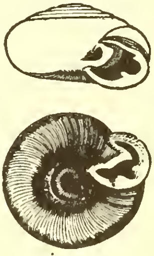
Dædalochila tholus, Tryon, Am. Journ. Conch., III. 64 (1867).

Texan Subregion, Washington and Bosque County, Texas; also in the neighboring Mexican States.

The specimens from which the descriptions of *Mooreana* and *tholus* were drawn are widely different, but a study of a large suite of individuals leads one to doubt their specific distinction. Although I now refer *P. tholus* to *Mooreana*, I here repeat the original description and figure.

Shell broadly umbilicated, depressed-globose, rather solid, white, shining, ribbed above, smoother below; spire obtuse, little elevated, rounded; whorls 7, convex, the upper ones more flattened, the last bluntly carinated; carina not reaching the peristome; base parallel to the suture; umbilicus broad, half the larger diameter of the shell, showing two and a half deeply grooved whorls plainly, the others rapidly retreating towards the apex; aperture very oblique, semicircular, removed from the axis of the shell, bordered with a scarcely reflected, white, heavy peristome, grooved behind, and armed with two stout teeth near the basal extremity, broadly reflected at the junction with the body whorl; on the parietal wall of the aperture is a white fold, hardly connecting the extremities of the peristome, and projecting across the aperture into an acute point; an internal transverse tubercle on the base of the shell. Greater diameter 11, lesser 9 mill.; height, 4 mill.

Fig. 171.



Helix tholus, enlarged.

The aperture of this curious shell (*tholus*) resembles that of *P. fatigiata*, Say. It is readily distinguished from that and all other described species by the umbilicus, broad at the commencement, and rapidly narrowing beyond the second whorl with the peculiar groove visible in all the whorls of the umbilicus, of the same character as that noticed by Say in *auriculata*, though deeper.

The name *tholus* is derived from the resemblance of the slightly raised, rounded spire to a low dome.

Jaw with about 15, adjoining, broad ribs, denticulating either margin.

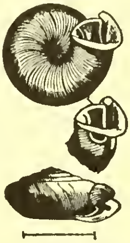
The lingual membrane of *Mooreana* (Pl. VI. Fig. Q) has 20—1—20 teeth, with 8 laterals. There are two transition teeth with simple inner cutting point.

Genitalia not examined.

Polygyra hippocrepis, PFEIFFER.

Shell rimately perforated, depressed, rather heavy, closely striated, opaque, smoky; spire flattened; suture impressed; whorls 5½, narrow, scarcely convex, the last subcarinated above, more convex below, falling abruptly at the aperture, and behind it very much contracted and with a prominent isolated bulge; umbilicus at first expanded and grooved, but rapidly terminating in a minute perforation; aperture almost horizontal, ear-shaped, ringent, complicated with teeth; peristome white, thickened, its extremities joined by an elevated, sharp, angular ridge, from which protrude far within the aperture two laminæ (the upper one sharper and more prominent), the connecting terminations of which within the shell resemble a horseshoe; the upper portion of the peristome is slightly reflected and furnished with an oblique entering angle, and the basal portion is callous and reflected; an internal transverse tubercle on the base of the shell. Greater diameter 12, lesser 10 mill.; height, 5 mill.

Fig. 172.



P. hippocrepis.

Helix hippocrepis, PFEIFFER in ROEMER'S Texas, 455 (1849); in Zeitsch. für Mal., 1848, 119; Mon. Hel. Viv., III. 267; in CHEMNITZ, ed. 2, II. 333, Pl. CXXXI. Figs. 4-6. — REEVE, Con. Icon., No. 1238 (1854). — W. G. BINNEY, Terr. Moll., IV. 77, Pl. LXXVIII. Fig. 19; L. & Fr.-W. Sh. I. 96, Fig. 172 (1869).

Dœdalochila (?) hippocrepis, TRYON, Am. Journ. Conch., III. 68 (1867).

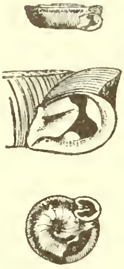
Texan Subregion, at New Braunfels, Texas.

Animal not observed.

Polygyra fastigans, L. W. SAY.

Shell rimately perforated, plane above, inflated below, with fold-like striæ above, smoother below, somewhat shining, of a russet horn-color, hirsute; spire flattened; whorls 6½, flattened, the last acutely carinated above, very abruptly deflected at the aperture, scrobiculated, constricted, convex below; aperture very oblique, subreniform, very much contracted, triden-

Fig. 173.



P. fastigans.

tate; within the base of the last whorl is a small, detached, erect, rounded tubercle; peristome white, reflected, its terminations joined by a stout, subtriangular, excavated, deeply entering tooth, the right-hand margin with a stout, deeply seated tooth, the columellar margin with a submarginal smaller tooth. Greater diameter 10, lesser 9 mill.; height, about 4 mill.

Polygyra fatigiata, SAY,[1] N. Harm. Diss., II. 229 (1829); ed. BINNEY, 37.

Helix fatigiata, BINNEY, in Bost. Journ. Nat. Hist., III. 388 (1840), ex parte (excl. syn. et Fig.); Terr. Moll., II. 193 (pars), Pl. XXXIX. Fig. 4 (excl. syn.). — SHUTTLEWORTH, Bern. Mitt., 1852, 197. — BLAND, N. Y. Lyc., VI. 283, Pl. IX. Figs. 17-20 (1858). — W. G. BINNEY, Terr. Moll., IV. 82; L. & Fr.-W. Sh., I. 97, Fig. 173 (1869). — PFEIFFER, Mon. Hel. Viv., IV. 318.

Helix Texasiana, β, PFEIFFER, Mon. Hel. Viv., I. 418; III. 267; in CHEMNITZ, ed. 2, I. 86, excl. descr., syn., et fig. — DESHAYES in FER., I. 74, excl. descr., syn., et fig.

Helix Dorfeuilliana, DESHAYES in FÉR., I. 73 (excl. syn.), Pl. LXIX. D, Fig. 3, not of LEA.

Helicina fastigiata, DEKAY, N. Y. Moll., 82 (1843).

Helix fastigans, L. W. SAY, MS. in BLAND, Ann. N. Y. Lyc., VII. 140.

Dædalochila fastigans, TRYON, Am. Journ. Conch., III. 67 (1867).

A species of the Cumberland Subregion, found in Tennessee at Clarkeville and Nashville and in Franklin County, in Kentucky in Henry County.

P. fastigans is larger than *Troostiana*, *Hazardi*, and *Dorfeuilliana*; it is most nearly allied to the first, and though it is connected with the second, is wholly distinct from the last. The parietal tooth is more rectangular than that of *Troostiana*, in which it is slightly emarginate near the tip, but much more so in *Hazardi*, while the parietal tooth in *Dorfeuilliana* is rather quadrate. The teeth on the peristome in *fastigans* and *Troostiana* are much alike, as regards form, size, and position, the superior one being the largest; both are larger and transverse in *Dorfeuilliana* and in *Hazardi*, the inferior one being the largest in the latter. Behind the peristome there are two small pits, showing the situation of the teeth in *fastigans* and *Troostiana*, while there is scarcely more than a deep, well-marked constriction in *Dorfeuilliana*. *H. Troostiana* has a slight groove on the inner side of the last whorl, the absence of which in *fastigans* is noticed by Say; but I scarcely consider that a good specific character. Fresh specimens of *fastigans* are, I believe, covered with a very thin epidermis, on which hairs are sparingly scattered, — the scars of the hairs may be detected, especially on the last whorl, in denuded shells.

P. fastigans has, at a short distance within the aperture on the base of the last whorl, a small, detached, erect, rounded tubercle, answering probably the same purpose in the economy of the animal, as the "fulcrum" originally noticed by Mr. Lea (Observations, Vol. V. p. 80) in *Strenotrema spinosum*, though of a different construction.

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[1] This name, or rather *fastigiata*, for which it was intended, is not preoccupied in *Polygyra*.

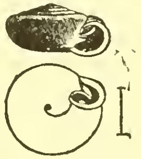
Jaw slightly arcuate, long, low, with about 20 ribs on the anterior surface, crenulating either margin.

P. fastigans (Pl. VI. Fig. H) has 21—1—21 teeth, with 8 laterals on the lingual membrane.

Polygyra Jacksoni, Bland.

Shell narrowly umbilicate, depressed, shining, dark or pale horn-colored, little elevated above, striated, convex beneath, with finer almost obsolete striæ; whorls 6, slightly convex, gradually increasing, the last suddenly deflected, contracted and above gibbously inflated behind the aperture; suture impressed; aperture oblique, lunate-circular, with 3 teeth; peristome thickened, brownish-red, shortly reflected, with the scarcely approaching margins joined by a white, linguiform, bicrural, deeply entering tooth, the basal margin with a strong, oblique, sinuous fold, the right with a deeply seated tooth. Greater diameter 7, lesser 6 mill.; height, 4 mill.

Fig. 174.



P. Jacksoni.

Helix Jacksoni, Bland, Am. Journ. Conch., II. 371, Pl. XXI. Fig. 8 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 98, Fig. 174 (1869).

Dædalochila Jacksoni, Tryon, Am. Journ. Conch., III. 67 (1867).

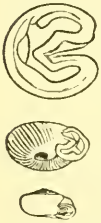
Fort Gibson, Indian (Cherokee) Territory; Springfield, Mo. I am inclined to rank it among the species of the Texan Subregion.

This species belongs to the same group as, and is most nearly allied to, *P. Hazardi*, Bland (*P. plicata*, Say), from which, however, it may be readily distinguished by the very different character of the parietal and basal teeth. This species has no internal tubercle.

Animal not observed.

Polygyra Troostiana, Lea.

Fig. 175.



P. Troostiana, enlarged.

Shell rimately umbilicated, discoidal, slightly convex above, flattened below, obtusely carinated, with separated strong rib-like striæ throughout,[1] hirsute, russet horn-color; spire not much elevated; whorls 5½, flattened, the last more convex, descending at the aperture, grooved behind the peristome, with a smoother bulge, below plane, widely rimated, and ending in a small umbilicus; aperture oblique, subreniform, very much contracted, far within on the base of the outer whorl with a small, detached, erect, rounded tubercle; peristome white, thickened, continuous, ends approached, joined by an excavated, emarginate, somewhat flexuose, slightly entering, tongue-like, heavy callus, the basal margin with a submarginal obtuse stout denticle, right margin with a more deeply seated, broader denticle. Greater diameter 9, lesser 8 mill.; height, 3 mill.

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[1] Some of the striæ extend over the carina on to the base of the shell without being carried into the umbilicus.

Polygyra Troostiana, LEA, Tr. Am. Phil. Soc., VI. 107, Pl. XXIV. Fig. 119; Obs., II. 107 (1839). — TROSCHEL, Arch. f. Nat., 1839, III. 222.

Helix Troostiana, PFEIFFER, Mon. Hel. Viv., I. 419, excl. syn. et var.; in CHEMNITZ, ed. 2, I. 376, Pl. LXV. Figs. 21-24. — DESHAYES in FÉR., I. 75, Pl. LXIX. D, Fig. 4? — REEVE, Con. Icon., No. 706 (1852). — W. G. BINNEY, Terr. Moll., IV. 88, Pl. LXXVIII. Fig. 11. — L. & Fr.-W. Sh., I. 98, Fig. 175 (1869). — BLAND, Ann. N. Y. Lyc., VI. 288, Pl. IX. Figs. 21-23 (1858).

Helix fatigiata, BINNEY, Bost. Journ. Nat. Hist., III. 388, Pl. XIX. Fig. 3, part, excl. syn.; in Terr. Moll., part, II. 193, Pl. XXXIX. Fig. 2.

Helix plicata, BINNEY (not of SAY), Terr. Moll., Pl. XXXIX. Fig. 2, not text.

Dædalochila Troostiana, TRYON, Am. Journ. Conch., III. 67 (1867).

Murfreesboro', and Franklin County, Tennessee; Kentucky. A species of the Cumberland Subregion.

P. Troostiana is very closely allied to *P. fastigans*, from which I separate it with some hesitation. In its fresh state it has a thin, sparingly hirsute epidermis. I have, moreover, two specimens in my cabinet (both hirsute), which are as acutely carinated as *fastigans*, with the striæ as prominent below as above (in one more numerous), but both having the parietal tooth of *Troostiana*.

I am not altogether satisfied with the validity of Shuttleworth's remark, that the superior tooth in *fastigans* is larger and more conspicuous than in *Troostiana*.

This species has the same tubercle within the last whorl as *fastigans*.

Jaw as usual in the subgenus *Polygyra*, with about 10, broad, crowded ribs, denticulating either margin.

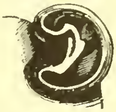
P. Troostiana (Pl. VI. Fig. D) has 25—1—25 teeth, with 8 laterals on its lingual membrane.

Genital system (Pl. XV. Fig. I) long and slender, especially the ovary and oviduct; vagina long, receiving the duct of the genital bladder below its middle, and the sac of the penis still lower down; penis sac long, tubular, of about same width as the vagina, with a prominent bulb at its apex, into the end of which is inserted the vas deferens and at the side of which the retractor muscle is attached; genital bladder moderate, oval, on a duct of about equal length and size as the vagina.

Polygyra Hazardi, BLAND.

Shell rimately umbilicated, discoidal, depressed above, convex below, light horn-color, sparingly hirsute, with separated rib-like striæ; spire planulate; whorls 5; gradually increasing, the upper ones rounded, smoother, the last convex, plane below, scrobiculated and with an insulated, smooth, prominent bulge behind the peristome, deflected at the aperture; rimation level, at first grooved, showing 1½ whorls, and ending in a narrow umbilicus; aperture subreniform, very oblique, contracted; peristome white, thickened, not reflected, continuous, its terminations approached, joined by a prominent, excavated, heavy, somewhat flexuose, emarginate, tongue-like callus, projecting almost across the aperture; within the columellar margin of the peristome is an erect, blunt, stout denticle (its inner end continued back within the aperture into an erect lamella joining the inner wall) somewhat overlapping and thus partially concealing from view a smaller, more deeply seated, erect, obtuse, stout denticle on the right margin of the peristome; an internal transverse tubercle on the base of the shell. Greater diameter 7, lesser 6 mill.; height, 3 mill.

Fig. 176.



P. Hazardi, enlarged.

Polygyra plicata,[1] Say, Journ. Acad. Phila., II. 161 (1821); ed. Binney, 21.
Helix fatigiata, Binney in Bost. Journ. Nat. Hist., III. 388 (1840), part (excl. syn. and fig.); in Terr. Moll. part (excl. syn. and fig.).
Helix Texasiana, Pfeiffer, Mon. Hel. Viv., I. 418 (excl. syn. and descr.); in Chemnitz, I. 85 (excl. syn., descr., and fig.).
Helix Dorfeuilliana, Deshayes in Fér., I. 73 (excl. descr., syn., and fig.).
Helix Troostiana, Pfeiffer, Mon. Hel. Viv., IV. 318, part.
Helix Hazardi, Bland, Ann. N. Y. Lyc., VI. 291, Pl. IX. Figs. 27-30 (1858). — Pfeiffer, Mal. Blatt., 1859, 34. — W. G. Binney, Terr. Moll., IV. 84, Pl. LXXVIII. Fig. 13. — L. & Fr.-W. Sh., I. 99 (1869).
Helix finitima, Deshayes in Fér. ?
Helicina plicata, DeKay, N. Y. Moll., 82 (1843).
Dædalochila Hazardi, Tryon, Am. Journ. Conch., III. 68 (1867).

Alabama (Tuscumbia), Kentucky (near Frankfort), Georgia, and Tennessee (Cumberland Mountains). A species of the Cumberland Subregion.

Animal small, smoky-white; head and eye-peduncles dark blue.

This shell may be distinguished from *fastigans* and *Troostiana*, independently of the absence of the carina, by its smaller size, and more particularly by the different form, relative size, and position of the teeth. In those species the superior tooth on the peristome is transverse, compressed, and larger than the inferior one, from which it is separated by a "remarkable sinus," distinctly visible on looking into the aperture; the inferior tooth is obtuse. Immediately behind the peristome, the position of the teeth is marked by small shallow pits, giving the character to the last whorl designated by Shuttleworth "*scrobiculato-constrictus*," and the striæ run over the whorl up to the peristome. In *Hazardi* the two teeth within the peristome are of the same character as the superior one in *fastigans* and *Troostiana;* the inferior tooth is, however, the larger, and so partially conceals the lower margin of the superior one as to obstruct the view into the aperture, and give no appearance of separation "by a remarkable sinus." Both the teeth are more deeply seated than in the other species. The nature of the scrobiculation behind the peristome in *Ha-*

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[1] By the strict laws of priority this name should be used, not being preoccupied in *Polygyra*.

zardi alone sufficiently distinguishes it from its allies. The space behind the peristome, and between it and the curved pit, showing the seat of the superior tooth, is convex and smooth, the striæ not extending over it.

This species has, in common with *fastigans* and *Troostiana*, a thin, brown, but more sparingly hirsute epidermis. I have noticed the tubercle within the last whorl, near the aperture, in *fastigans* and *Troostiana*, but no such process exists in the species now under consideration. In *Hazardi* the inferior tooth of the peristome, at its inner end, is continued back within the aperture, forming a white erect lamella on the floor of the whorl, parallel with, and leaving a narrow sinus between it and the inner wall, to which it is joined at its extremity, about two and a half millimetres from the edge of the peristome. The position of this lamella can be seen through the shell.

Jaw as usual in the genus; ribs numerous.

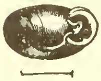
Lingual membrane (Pl. VI. Fig. O) has 16—1—16 teeth, with 8 laterals. At least three of the transition teeth, or first marginals, have no bifurcation to the inner cutting point. Beyond these, the marginals have the point bifid.

Genitalia unobserved.

Polygyra oppilata, MORICAND.

Shell umbilicated, depressed, delicately striate, subpellucid, light horn-color or white; spire scarcely elevated; whorls 5, rather convex, gradually increasing, the last deflected at the aperture, inflated below, constricted behind the peristome; umbilicus at first widened, then narrow, pervious; aperture diagonal, lunately circular, ringent; peristome briefly reflected, its terminations joined by a tongue-shaped, entering, two-forked callus, the right margin subequally bidentate. Greater diameter 7, lesser 6 mill.; height, 3 mill.

Fig. 177.



P. oppilata.

Helix oppilata, MORICAND, Test. Noviss., I. 8. — PFEIFFER, Mon. Hel. Viv., III. 264; IV. 314. — W. G. BINNEY, L. & Fr.-W. Sh., I. 101, Fig. 177 (1869). — FISCHER and CROSSE, Moll. Mex. et Guat., 287 (1870).

The specimen figured is from Yucatan; Pfeiffer on Shuttleworth's authority refers to Florida a var. *β* with a somewhat more elevated spire, 5½ whorls, and 8⅔ mill. in the greater diameter. The specimen dissected by me is from Cedar Keys.

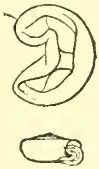
The above figure is referred to *implicata*, Beck, by Crosse and Fischer, l. c.

Lingual membrane (Pl. XVI. Fig. D) as usual in the genus. The inner marginals have simple cutting points.

Polygyra Dorfeuilliana, LEA.

Shell rimately umbilicated, discoidal, slightly convex above, flattened below, light horn-colored, striated, below smoother and with minute revolving lines; spire not much elevated; whorls 6, flattened, gradually increasing, the last more convex, inflated below, constricted behind the peristome, descending at the aperture, below with a grooved rimation of 1½ whorls, ending in a very small umbilicus; aperture oblique, subreniform, contracted, far within furnished with a deeply seated, erect tubercle on the base of the last whorl; peristome white, very much thickened, not reflected, continuous, its terminations but slightly approached, joined by a heavy, excavated, subquadrate callus projecting across the aperture, the columellar margin with a deeply seated, transverse, somewhat pointed denticle, distinctly separated from a broader, equally deeply seated obtuse denticle on the right margin. Greater diameter 8, lesser 7 mill.; height, 3½ mill.

Fig. 178.



P. Dorfeuilliana, enlarged.

Polygyra Dorfeuilliana, Lea, Trans. Am. Philo. Soc., VI. 107, Pl. XXIV. Fig. 118; Obs. II. 107 (1839); Troschel's Arch. f. Nat., 1839, II. 222.

Helix Dorfeuilliana, Bland, Ann. N. Y. Lyc. (1858), VI. 294, Pl. IX. Figs. 24–26. — W. G. Binney, Terr. Moll., IV. 86, Pl. LXXVIII. Figs. 2, 14; L. & Fr.-W. Sh., I. 101, not of Pfeiffer, Deshayes, Chemnitz, Reeve.

Helix fatigiata, Binney, Bost. Journ. Nat. Hist., III. 388 (1840); Terr. Moll., II. 193 (excl. descr., syn., and fig.).

Helix Troostiana, var. ? Pfeiffer, Mon. Hel. Viv., III. 318, no descr.

Dædalochila Dorfeuilliana, Tryon, Am. Journ. Conch., III. 66 (1867).

Washington County, Texas; Washita Springs, Arkansas; Coosa River, Alabama; Kentucky, opposite Cincinnati. It thus appears much more widely distributed than the allied species, perhaps enough so to be considered a species of the Interior Region.

Mr. J. G. Anthony obtained from Mr. Dorfeuille some facts concerning the original discovery of this species, which prove beyond all doubt that it was accidentally brought from Kentucky. It is not an inhabitant of Ohio.

P. Dorfeuilliana differs materially in its characters from the allied species; the striæ on the upper surface are not so well defined as in *Troostiana*, but more so than in *Hazardi*, while the base is more smooth than in either of them, having only very delicate striæ, with microscopic impressed spiral lines. The parietal tooth is quadrate — the two teeth on the peristome are more nearly of the same size and form than in *fastigans* and *Troostiana*. In this species the inferior tooth is transverse, and in some specimens broader than the superior one, but has a somewhat pointed apex; both are very nearly equally deeply seated, but so far apart as to allow a view between them into the aperture, leaving, as Mr. Lea expresses it, " to appearance three nearly square apertures." Say would have described the two teeth as " separated by a remarkable sinus." The peristome of this is more thickened and less reflected than in the other species; behind it is deeply constricted, without any appearance of pits showing the position of the teeth within.

There is a form of *Dorfeuilliana* which differs from the type in that the superior tooth on the peristome is larger and more deeply seated than the inferior one, and that the latter, though more developed, is much of the same form as the inferior tooth in *fastigans* and *Troostiana*. The parietal tooth partakes of the general character of that in Lea's type of *Dorfeuilliana*, but its lower and terminal margins project more perpendicularly from the parietal wall. The umbilical perforation is also larger, and the base of the shell is more smooth. The following are the measurements of a large specimen : Greater diameter 9, lesser 8 mill.; height, 4 mill. I am much inclined to consider this a distinct species, but remark upon it, as I believe it is more commonly found in cabinets under the name of *Dorfeuilliana*, than the shell described by Lea.

P. Dorfeuilliana, and also the shell last considered, have a tubercle within the aperture very similar to that in *fastigans* and *Troostiana*.

Jaw not observed.

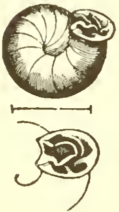
Lingual membrane with 20—1—20 teeth, the tenth having its inner cutting point split. Marginals as usual in the genus. Pl. VI. Fig. I.

Genitalia unobserved.

Polygyra Ariadnæ, Pfr.

Shell with an arcuate rimation, terminating in a minute oblique perforation, depressed, subdiscoidal, rather solid, nearly transparent, bluish-white, with scarcely perceptible wrinkles on the upper surface; spire flattened; whorls 5, separated by a distinct suture, flattened, the last one suddenly falling towards the aperture, very much contracted and pinched behind the peristome, more convex and smoother below; there is a deeply chiselled, arcuated, umbilical rimation, the umbilical region is also channelled; aperture small, extremely complicated with teeth, very oblique, lunately circular, ringent; peristome white, slightly reflected, its terminations approaching each other and joined by two flexuose, elevated, acute laminæ, converging to a point far within the aperture; the basal margin of the peristome is also furnished with two stout, entering, converging marginal folds; the right margin of the peristome has a more delicate, deeply seated, elongated lamina, running almost parallel with the peristome. Greater diameter 12, lesser 10 mill.; height, 5 mill.

Fig. 179.



P. Ariadnæ.

Helix Ariadnæ, Pfeiffer in Zeitsch. f. Mal., 1848, 120; Mon. Hel. Viv., III. 266; in Chemnitz, ed. 2, I. 372, Pl. LXV. Figs. 19–21 (1846). — W. G. Binney, Terr. Moll., IV. 76, Pl. LXXVIII. Figs. 1, 3, 4; L. & Fr.-W. Sh., I. 104, Fig. 180 (1869). — Fischer and Crosse, Moll. Mex. et Guat., 287, Pl. XII. Fig. 8 (1870).

Helix Couchiana, Lea, Proc. Acad. Nat. Sci. Phila., 1857, 102; Journn. —; Obs., XI. 139, Pl. XXIV. Fig. 112.

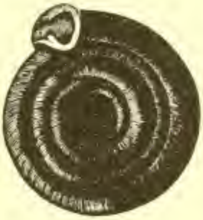
Dædalochila Ariadnæ, Tryon, Am. Journ. Conch., III. 66 (1867).

In the region of the Rio Grande, both in Texas and Tamaulipas. A species of the Texan Subregion.

Animal not observed.

Polygyra septemvolva, SAY.

Fig. 180.



P. septemvolva, enlarged.

Shell broadly umbilicated, subcarinated, discoidal, russet horn-color, with stout striæ above, smooth below; plane above, with 7 (sometimes 8½) or less flattened whorls; equally plane below, with 3½ full, more convex whorls on a level, then ending in a deep, pervious umbilicus, the penultimate somewhat overlapped by the last, the antepenultimate much the largest; aperture very oblique, remote from the axis, subreniform, constricted behind the peristome; peristome thickened, bluntly reflected, continuous, its terminations joined by an elevated, heavy, tooth-like triangular fold. Greater diameter 15, lesser 13 mill.; height, 4 mill.

Polygyra septemvolva, SAY, Journ. Acad. Nat. Sci. Phila., I. 278 (1818); Nich. Encycl., 3d ed. (1819); BINNEY'S ed. 11. — TRYON, Am. Journ. Conch., III. 159 (1867).

Helix septemvolva, BINNEY, Terr. Moll. U. S., II. 196 (part), Pl. XXXVIII. outer Figs.; Pl. XXIX. Fig. 1. — DEKAY, N. Y. Moll., 47 (1843). — BLAND, Ann. N. Y. Lyc., VII. 131, Fig. on p. 136. — W. G. BINNEY, Terr. Moll., IV. 89, part; L. & Fr.-W. Sh., I. 104 (1869). — PFEIFFER, V. 419 (1868).

? *Helix volvoxis*, PFEIFFER, see below.

St. Augustine, Florida. Confined to the Florida Subregion.

Animal (see p. 262) brownish, eye-peduncles darker, very long and slender, eyes black; foot narrow, thin, semi-transparent, receiving its color, in some degree, from the substance on which it is placed, not projecting behind the shell when in motion; length less than twice the breadth of the shell, which it carries nearly horizontal.

The shell described and figured above, which is, no doubt, the form called *septemvolva* by Say, is only found, to my knowledge, at St. Augustine, Florida.[1] There are, however, associating with it there, and also found at many other points on the Georgia, Florida, and Alabama coasts, other forms which appear to be varieties of it. It may be said, therefore, that it varies in being occasionally a little convex, more or less carinate, and in exhibiting a greater or less number of full volutions on the base. The lower surface is sometimes marked with the alternate white and brown flammules which characterize *P. Carpenteriana*.

The reflected peristome in this shell seems to be formed at various periods of growth, thus creating a greater diversity of size in the apparently mature shell than exists in any other species. From the nucleus until the accomplishment of five full whorls, each whorl on the base is curved a little lower than that which precedes it; and up to this time, consequently, the umbilicus is deep and gradually expanding, exhibiting, when carefully examined, all the volutions. Up to this period, also, the spire is almost always prominent. After five whorls are completed, the succeeding ones usually follow in the same horizontal plane, and give a discoidal character to the shell. It is manifest, therefore, that specimens in each of these stages must present considerable differences; and, accordingly, the small, delicate shell, having a slightly convex spire of five whorls, a deep umbilicus, and a transverse diameter of only one eighth of an inch, forms a beautiful variety, and has been thought to be a distinct species.

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[1] Recently specimens have been received from Key West.

The form known as *volvoxis* is found on the Atlantic coast of Florida and Georgia. It is thus described by Pfeiffer. The synonymy is also given in full. I believe it to be a variety of *septemvolva*: —

Shell umbilicated, orbicularly convex, thin, reddish horn-colored, pellucid, with regular rib-like striæ; spire very short, convex; whorls 7, convex, regularly increasing, the last larger above than the rest, angular, below the angle inflated, striated, and shining; umbilicus large, regular, in which the whorls regularly decrease, excepting the last, which is very broad; aperture rather large, kidney-shaped; peristome thickened within, reflected, its terminations joined by a short, triangular, tooth-like callus. Greater diameter 9, lesser 8 mill.; height, 4 mill.

Helix volvoxis, PARREYSS in PFEIFFER, Symb., III. 80; Mon. Hel. Viv., I. 409; in CHEMNITZ, ed. 2, I. 379 (1846), Pl. LXVI. Figs. 4-6 (1849). — REEVE, Con. Icon., No. 1237 (1854). — W. G. BINNEY, Terr. Moll. U. S., IV. 92, Pl. LXXVIII. Fig. 17. — BLAND, Ann. N. Y. Lyc., VII. 135.

Polygyra volvoxis, TRYON, Am. Journ. Conch., III. 159, Pl. XI. Fig. 25 (1867).

Jaw long, narrow, slightly arched; ends attenuated, bluntly rounded; anterior surface with 7 stout, distant ribs, crenulating the cutting edge.

There are 28—1—28 teeth, with 9 laterals on the lingual membrane of the large form (Pl. VI. Fig. L). The small form with 5 whorls differs only in having somewhat fewer teeth. The form known as *volvoxis* does not differ excepting in having fewer marginals; Jacksonville, Florida, specimens have 20—1—20 teeth.

The Museum of Comparative Zoölogy at Cambridge has a reversed specimen of *P. septemvolva.*

Plate XV. Fig. H represents the genital system of the large form of this species. It is characterized by its extreme length, as would be expected from the form of the shell. The vagina is extremely long and narrow. The genital bladder is elongated oval, on a short, slender duct. The penis sac is very long, attenuated to a point above, where the retractor muscle is inserted.

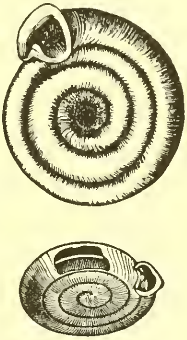
“The digestive system is also very much elongated. The œsophagus especially is excessively long, as are also the ducts to the salivary glands.

This species is extremely common all over St. Augustine and its vicinity. The large form I found almost restricted to the moat of the old fort, especially at the foot of the main western wall.

Polygyra cereolus, Muhlfeldt.

Shell broadly umbilicated, subcarinated, discoidal, white, scarcely convex, and with rib-like striæ above, smooth and plane below; whorls 7 or 8, gradually increasing, the last subcarinated, briefly deflected at the aperture, constricted behind the peristome; below three full whorls revolving on the same plane, the balance visible in the broad, pervious umbilicus, the penultimate somewhat lapped over by the last, the antepenultimate the most swollen; aperture remote from the axis, subreniform; peristome white, thickened, acutely reflected, somewhat angular at the carination of the last whorl, continuous, its terminations joined by triangular, elevated, acutely pointed callus; on the parietal side of the inner fourth of the last, and running round rather obliquely within from two thirds to three fourths of the penultimate whorl, thus revolving nearly once round the shell, is a thread-like, elevated, white internal lamina. Greater diameter 14, lesser, $12\frac{1}{2}$ mill.; height, $3\frac{1}{2}$ mill. A large specimen, 20 greater diameter.

Fig. 181.



P. cereolus, enlarged.

Helix cereolus, Muhlfeldt, Berlin Mus., VIII. (1816), 41, Pl. II. Fig. 18. — Pfeiffer, Mon. Hel. Viv., I. 408; in Chemnitz, ed. 2, I. 378, Pl. LXVI. Figs. 1 – 3. — ? Reeve, Con. Icon., 698. — Bland, Ann. N. Y. Lyc., VII. 136, Fig. 2. — W. G. Binney, Terr. Moll., IV. 80, part, Pl. LXXVII. Fig. 23; L. & Fr.-W. Sh., I. 106, Fig. 182 (1869).

Helix septemvolva, ? Férussac, Hist., Pl. LI. Fig. 6. — ? Wood, Index Test. Suppl., VII. Fig. 14; ed. Hanley, 226, Fig. 14. — ? Sowerby, Conch. Man., ed. 2, Fig. 275. — Binney, Bost. Journ. Nat. Hist., III. 391, Pl. XIX. Fig. 4 (1840); Terr. Moll., II. 196, Pl. XXXVIII. central line. — Deshayes in Fér. Hist., 5.

Helix planorbula, Lamarck ? An. s. Vert., VI. 89. — ? Deshayes in Lam., VIII. 67; Encycl. Méth., II. 208 (1830). — ? Delessert, Rec., Pl. XXVI. Fig. 3 (1841). — ? Chenu, Illust. Conch., Pl. XII. Fig. 3.

Helix cereolus, var. *laminifera*, W. G. Binney, Proc. Acad. Nat. Sci. Phila. 1858, 200, no descr.

Polygyra cereolus, Tryon, Am. Journ. Conch., III. 158, Pl. XI. Figs. 19 – 21 (1867).

Indian River, Indian Key, Key West, Egmont Key, Florida. It is a species of the Florida Subregion.

The umbilical opening, in specimens of about equal size, is only half the width of that in *septemvolva;* the last whorl is wider, especially towards its termination at the aperture, more inflated, and rather less acutely carinated. The aperture is more orbicular, more contracted, and the peristome more expanded and acutely reflected, and at its junction below with its pillar lip more closely appressed to the last whorl.

Fig. 181 represents a specimen broken, so as to show the internal lamina.

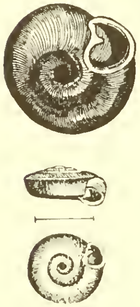
Jaw as usual; 14 ribs.

There are 22—1—22 teeth, with 9 laterals on the lingual membrane, the inner cutting point of the tenth tooth being bifid. Marginals with base of attachment low, wide, with one inner, long, oblique, bifid cutting point, and one short bluntly bifid, small, outer cutting point (Pl. VI. Fig. K), all of same type as in *septemvolva.*

Genitalia as in *P. septemvolva.*

Polygyra Carpenteriana, Bland.

Fig. 182.



P. Carpenteriana, enlarged.

Shell umbilicate, orbicular, horn-colored or pale rufous, above flat, obliquely and acutely ribbed, beneath convex, slightly striated, shining, often ornamented with indistinct white spots; suture deeply impressed; whorls 5½ to 6½, the last subangular at the periphery, shortly but suddenly deflected at the aperture, gibbous, scrobiculate, constricted, tumid behind the aperture, and ribbed, base dilated, with a white internal thread-like lamina[1] on the columellar wall near the point of attachment of the aperture; aperture very oblique, lunate; peristome callous within, thickened, little reflected, the margins joined by a triangular dentiform lamella. Greater diameter 10, lesser 9 mill.; height, 4 mill.

Helix microdonta, Pfeiffer, Mon. Hel. Viv., 499, ex parte? (1848). — W. G. Binney, Terr. Moll., IV. 91, Pl. LXXVIII. Fig. 28, excl. fig.

Helix Carpenteriana, Bland, Ann. N. Y. Lyc., VII. 137. — W. G. Binney, L. & Fr.-W. Sh., I. 107, Fig. 183 (1869).

Polygyra Carpenteriana, Tryon, Amer. Journ. Conch., III. 159, Pl. XI. Fig. 24, not 23 (1867).

In the Florida Subregion on the mainland of the extreme southern part of the peninsula and on the Keys from Little Sarazota Bay to Key Biscayne. I have received fossil specimens, imbedded in limestone rock.

This species has been hitherto named *microdonta* in American cabinets. It is readily distinguished from all the other species of the group by its strong acute rib-like striæ, and the peculiarity of the outer whorl. About the last third of it, behind the aperture, is ribbed and tumid; the whorl is then rather abruptly contracted, becoming narrower above, and flattened and slightly striated beneath, but again, as it passes towards and beneath the aperture, dilated and convex. This change of form gives to the last whorl a distorted appearance. The internal lamina is on the columellar wall of the contracted and flattened portion of the last whorl, and runs obliquely, in the direction of the aperture, attaining a length in a large specimen of about 6 mill. The character of the aperture is most like that of *cereolus*, but in that species the last whorl has none of the peculiarities above described. The internal lamina is found in a majority of specimens, but not in all; it can generally be seen through the outer wall of the shell.

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[1] As in *H. cereolus,* see Fig. 181, p. 283.

The upper figure is engraved directly from a photograph on wood.

Jaw as usual in the genus; over 12 ribs. One jaw examined has a decided median projection.

Lingual membrane with 22—1—22 teeth, of which 9 are laterals, the tenth tooth having its inner cutting point bifid (Pl. VI. Fig. M).

I can now state that *cereolus*, *Carpenteriana*, *septemvolva*, *volvoxis*, and *Febigeri* have the same dentition. In all, the splitting of the inner cutting point commences at the tenth tooth. The species also agree in their genitalia.

Genitalia as in *P. septemvolva*.

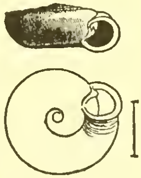
Polygyra Febigeri, Bland.

Shell umbilicate, orbicular, flat, thin, shining, pale or reddish horn-colored, with rather distant rib-like striæ above, finely striated beneath; spire almost level; suture deep; whorls 5½ to 6, rather convex, regularly increasing, the last angular at the periphery, inflated below; umbilicus funnel-shaped; aperture oblique, kidney-shaped; peristome thickened, little reflected, the margins joined by a strong triangular callus. Greater diameter 8½, lesser 7½ mill.; height, 3½ mill.

Helix Febigeri, Bland, Am. Journ. Conch., II. 373, Pl. XXI. Fig. 10 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 108, Fig. 184 (1869).

Polygyra Febigeri, Tryon, Am. Journ. Conch., III. 160 (1867).

Fig. 183.



P. Febigeri.

New Orleans; Mobile. A species of the Southern Region.

This species certainly differs from *P. cereolus*, Muhl., *septemvolva*, Say, *volvoxis*, Parr., and *Carpenteriana*, Bld., the four species of the same group hitherto found on the North American continent. Compared with *paludosa*, Pfr., of Cuba, the rib-like striæ are more regular and prominent, it is more decidedly angular at the periphery, and the form and armature of the aperture are different. In *Febigeri* there is no such excavation below the angle of the periphery as prevails, more or less, in the other above-named continental species. In this respect, and in the form of the aperture, *Febigeri* appears to be most nearly allied to *microdonta*, Desh., of

Bermuda and New Providence, but it is more coarsely striated, and the last whorl is more inflated below.

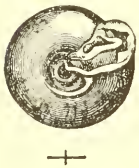
Jaw as usual; 10 ribs.

P. Febigeri (Pl. VI. Fig. J) has 17—1—17 teeth on the lingual membrane, with 9 laterals, the tenth tooth having a bifid inner cutting point.

Genitalia as in *P. septemvolva*, *cereolus*, and *Carpenteriana*.

Polygyra pustula, Fér.

Fig. 184.



P. pustula.

Shell umbilicated, orbicularly depressed, minutely striated, reddish or pale horn-color, hirsute; spire scarcely elevated; whorls 4½, flattened, gradually increasing, the last more convex below, deflected at the aperture, constricted behind the peristome; umbilicus broad, pervious, with a deep groove marked within the shell by an internal, revolving, ridge-like lamella, branching from a stout, transverse, internal tubercle; aperture very oblique, narrow, sinuously lunate; peristome sinuous, white, thickened, acute, somewhat reflected, its terminations joined by a two-forked, elevated, acutely pointed lamina, the basal margin with two approximated acute denticles, the columellar termination entering and somewhat covering the umbilicus. Greater diameter 5, lesser 4 mill.; height, 2½ mill.

Helix pustula, Férussac, Hist., Pl. I. Fig. 1. — Deshayes in Fér. I. 78, t. I. Fig. I. — Pfeiffer, Symb., III. 81; Mon., I. 422; IV. 268, excl. β; in Chemnitz, ed. 2, I. 376, Pl. LXV. Figs. 18–20 (1846). — Reeve, Con. Icon., 721 (1852). — Bland, Ann. N. Y. Lyc., VI. 346, Fig. 1 (1858). — W. G. Binney, Terr. Moll., IV. 94, Pl. LXXVII. Fig. 12; L. & Fr.-W. Sh., I. 109 (1869). — Not of Binney.

Dædalochila pustula, Tryon, Am. Journ. Conch., III. 62 (1867).

A species of the whole Southern Region, having been received from Texas, Cedar Keys, St. Augustine, South Carolina, and Lee County, Georgia.

The groove within the umbilicus is a very marked feature in Férussac's species, and though not referred to in his description, is distinctly shown in one of the figures; it is entirely wanting in *leporina*, and also in *pustuloides*. This groove is not only an external character, but its presence modifies the internal structure of the shell. On opening the base of the last whorl immediately behind the aperture, a strongly developed transverse tubercle is seen within, from which a strong ridge-like lamella runs round the umbilical opening, corresponding in extent with the groove. This tubercle, and the extension of it, are entirely disconnected by a sinus or channel from the floor of the penult whorl.

The hirsute character of this species is not generally alluded to by authors. The outer edge of the peristome in specimens from St. Augustine is of a deep rose-color.

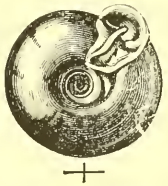
Jaw as usual; 14 crowded ribs.

P. pustula (Pl. VI. Fig. E) has 17—1—17 teeth on its lingual membrane, with 8 laterals.

Polygyra pustuloides, Bland.

Shell widely umbilicate, planorboid, thin, rufous or pale horn-colored, delicately striated, with thin, sparingly hirsute epidermis; spire scarcely elevated; whorls 4 to 4½, slightly convex, gradually increasing, the last subangular at the periphery, at the aperture gibbous, constricted, suddenly deflected, beneath devious; suture rather deeply impressed; umbilicus wide, equal to one-third of the larger diameter of the shell, showing all, but especially the penult whorl; aperture with an internal, fulcrum-like process on the base of the shell, oblique, crescentic, with an erect, oblique, white, parietal lamelliform tooth, joined to the upper angle of the aperture by a slightly arcuate, filiform callus; peristome reflected, with margins approaching, and having two dentiform lobes separated by a deep fissure. Greater diameter 5½, lesser 4½ mill.; height, 2½ mill.

Fig. 185.



P. pustuloides.

Helix pustula, Binney, Terr. Moll., II. 201, Pl. XXXIX. Fig. 3, not of Férussac.

Helix pustuloides, Bland, Ann. N. Y. Lyc., VI. 350, Fig. 3 (1858). — W. G. Binney, Terr. Moll., IV. 93; L. & Fr.-W. Sh., I. 110 (1869).

Dædalochila pustuloides, Tryon, Am. Journ. Conch., III. 61 (1867).

Georgia and Alabama. A species of the Southern Region.

P. pustuloides is intermediate in size between *pustula* and *leporina*, — is less globose than the former, and more sparingly hirsute. It differs widely from both in the character of the umbilicus; the aperture is much like that of *pustula*, but more narrow than that of *leporina*. The inferior tooth on the peristome is more developed laterally than in *pustula*, — indeed, it has a somewhat bifid appearance, in which respect it is more allied to *leporina*.

The *fulcrum* in *pustuloides* is of the same nature as that in *leporina*, but less developed, and with the outer edge entire.

As to the *station* of the species, I copy the following from one of Dr. Wilson's interesting letters from Darien, Georgia: —

"The place has an eastern exposure to the sea, high tides rising to the base of the low bluff where they exist. The growth of trees, which consists mostly of live oak and *Celtis occidentalis*, has never been cleared off; the *Palmetto serrulata* flourishes as an undergrowth. The soil is covered for a few inches in depth with oyster-shells thrown there by the Indians, and decayed leaves and fragments of branches are of course over all these, under which, and among the superficial oyster-shells, the *Helices* live. *P. pustula* is nowhere near, or at least a rigid search did not reveal any. *Macrocyclis concava* (dead) occurs in small numbers, *Triodopsis inflecta* abundantly."

Jaw as usual in the genus; over 10 ribs.

Lingual membrane with 17—1—17 teeth, 8 laterals, the ninth tooth having bifid inner cutting point (Pl. VI. Fig. C).

Genitalia unobserved.

Polygyra leporina, Gould.

Vol. III. Pl. XL. *a*, Fig. 1.

Shell with a partially covered umbilicus, depressed, orbicular, thin, reddish horn-color, delicately striated, and, when fresh, having a delicate down on its surface; spire depressed, composed of 5 slightly convex whorls, the last of which is obtusely angular at its upper portion; base convex, excavated at the umbilical region, with a minute, partially covered umbilicus; aperture oblique lunate; peristome incumbent, rose-colored, reflexed, bearing on its dilated basal edge two expanded teeth separated by a deep, narrow fissure, its terminations joined by a quadrate, erect, oblique lamella, whose upper edge is joined to the upper angle of the aperture by a thread-like callus; an internal, fulcrum-like tubercle, with uneven outer edge, on the base of the shell. Greater diameter 6, lesser $5\frac{1}{2}$ mill.; height, 3 mill.

Helix leporina, Gould, Proc. Bost. Soc., III. 39 (1848); in Terr. Moll., II. 199, Pl. XL. a, Fig. 1. — Reeve, Con. Icon., 722 (1852). — Bland, Ann. N. Y. Lyc., VI. 348 (1858). — W. G. Binney, T. M., IV. 92; L. & Fr.-W. Sh., I. 111 (1869). — Pfeiffer, Mon. Hel. Viv., IV. 320, no descr.

Helix pustula, Pfeiffer, Mon. Hel. Viv., I. 70, descr. : var. β; III. 268, not of Férussac.

Dædalochila leporina, Tryon, Am. Journ. Conch., III. 61 (1867).

Indiana, Illinois, Arkansas, Mississippi, Marengo County, Alabama, Georgia, Texas. A species of the Southern Region, ranging quite into the Interior Region.

P. leporina is larger than *pustula*, less elevated, the whorls are less convex, the incremental striæ less numerous and distinct, and the aperture is wider. The umbilicus is more nearly covered by the peristome, and is without the groove which prevails in *pustula*. Within and near the aperture there is what may be called the *fulcrum*, extending from the floor of the last to that of the penultimate whorl, and approaching in character to, but less strongly developed, than that in *Stenotrema monodon*. The outer edge of this *fulcrum* is uneven, — in one specimen somewhat denticulated.

Genitalia not observed.

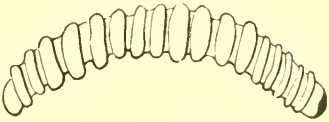
Jaw as usual; over 11 stout, separated ribs. A strong upper muscular attachment.

Lingual membrane as usual in the subgenus (Pl. VI. Fig. F). Teeth 18—1—18, with 8 laterals.

POLYGYRELLA, Bland.

Animal heliciform; mantle subcentral; other characters as in *Patula*.

Fig. 186.



Jaw of. *P. polygyrella*.

Shell widely umbilicated, discoidal, ribbed above, smoother below; whorls 7 – 8, gradually increasing, the last deflected above, furnished within with two rows of three teeth; base flattened, umbilicus of equal size to the apex; aperture subvertical, oblique, lunate-oval; peristome white, simple, much thickened within, margins joined by a white, pliciform, elevated, triangular tooth.

Central Province; a single species known.

Jaw of the only known species, *P. polygyrella*, very low, wide, very slightly arcuate, ends very gradually attenuated: cutting margin without median projection: anterior surface with numerous (even 26), broad, slightly separated ribs, denticulating either margin.

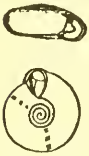
Lingual membrane (Pl. VII. Fig. A) long and narrow. Teeth 27—1—27, with 5 perfect laterals. Centrals subquadrate, the lower lateral angles but little expanded; the upper margin broadly reflected: reflection large, wide, with distinct, but small, rounded side cusps bearing short conical cutting points, and a very stout median cusp reaching the lower margin of the base of attachment, beyond which projects the short, stout, conical cutting point. Laterals like the centrals, but asymmetrical by the suppression of the inner, lower angle of the base of attachment, and the inner side cusp and cutting point. First marginals a simple modification of the laterals by the lesser development of the cutting point (*b*). Outer marginals (*c*) low, wide, the reflection equalling the base of attachment and bearing one inner, short, stout, oblique cutting point, and two shorter outer blunt cutting points.

Polygyrella is quite distinct from all the other American genera by the form of its jaw and the large number of ribs upon its anterior surface.

Polygyrella polygyrella, Bland.

Shell widely umbilicate, discoidal, flat, shining, translucent, yellowish horn-colored, ribbed above, the ribs obsolete near the aperture, base rather smooth; spire scarcely elevated; whorls 7 to 8, somewhat convex, gradually increasing, the last slightly deflexed above, armed within with two rows of three teeth, seen through the outer wall; umbilicus pervious, of equal size to the apex; aperture subvertical, oblique, lunate-oval; peristome depressed above, white, simple, much thickened within, the margins joined by a white, pliciform, elevated, triangular tooth. Greater diameter 11½, lesser 10½ mill.; height, 5 mill.

Fig. 187.



P. polygyrella.

Helix polygyrella, BLAND & COOPER, Ann. N. Y. Lyc., VII. 365, Pl. IV. Figs. 13–15 (1861). — W. G. BINNEY, L. & Fr.-W. Sh., I. 112 (1869).
Polygyra polygyrella, TRYON, Am. Journ. Conch., III. 160 (1867).

Central Province. Common on the Cœur d'Alêne Mountains, especially on their eastern slope, in spruce forests.

Jaw and lingual membrane (see p. 289).

Genitalia unknown.

STENOTREMA, RAF.

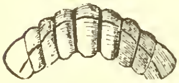
Animal heliciform, mantle subcentral; other characters as in *Patula*.

Shell with the perforation covered, lenticular or globosely depressed, hairy; whorls 4½–6, the last anteriorly gibbous, shortly deflexed, tumid below; spire somewhat elevated; peristome with a white, thickened margin, briefly reflexed above, somewhat constricted in its basal portion, usually sinuous and dentate, furnished with an internal transverse tubercle on the floor of the base of the last whorl.

A North American genus, meeting its greatest development in the Cumberland Subregion.

Jaw thick, high, arched; ends but little acuminated, blunt; cutting margin without median projection; anterior surface with stout, broad, crowded ribs, denticulating either margin. There are about 8 in *stenotremum*, 11 in *germanum*,[1] 7 in *monodon*, 8 in *hirsutum*, 13 in *Edvardsi*, 12 in *barbigerum*, 8 in *spinosum*, 12 in *labrosum*.

Fig. 188.



Jaw of *S. monodon* (Morse).

I have had no opportunity of examining *Edgarianum* or *maxillatum*.

The subgenus is restricted to North America as far as known. It differs from our other subgenera in having its ribs much broader and much more closely crowded.

Lingual membrane arranged as in *Patula*. Centrals with a base of attachment longer than wide, the lower lateral angles but little expanded, the lower margin incurved, the upper margin squarely reflected; reflection large, wide, with small, in some species almost obsolete, side cusps, always bearing distinct, well-developed cutting points; and a very stout median cusp, bearing a stout cutting point which usually projects beyond the lower edge of the base of attachment. Laterals like the centrals, but asymmetrical by the suppression of the inner lateral angle of the lower edge of the base of attachment and the inner side cusp and cutting point. The transition from laterals to marginals is shown in Pl. VII. Fig. B (*S. spinosum*). It is, as usual, produced by the comparative lesser development of the inner cusp and greater development of its cutting point. This cutting point becomes bifid, the reflection becomes shorter, the cutting points more produced, and thus gradually the form of the marginal teeth is reached. They are low, wide, the reflection equalling the base of attachment, the cutting points long, oblique, usually two in number, the inner one generally, and the outer one rarely, bluntly bifid: the outer bifurcation of each is more produced than the inner. There is great variation in the denticulation of the marginal teeth even on the same lingual membrane. A transition from laterals to marginals similar to that of *S. spinosum* is found in *S. barbigerum*, *labrosum*, *Edvardsi*, *stenotremum*, *hirsutum*, *germanum*, and *monodon*.

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[1] See Ann. Lyc. N. H. N. Y., X. Pl. XIV. Fig. 4. Perhaps a *Mesodon*.

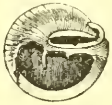
There seems no difference in the characters of the teeth of the different species examined by me, excepting the slight one of the greater or lesser development of the side cusps of centrals or laterals, especially the former; whether this is constant can only be proved by a careful examination of every portion of each lingual. In *S. hirsutum* I found these cusps more developed than in the other species.

Stenotrema spinosum, Lea.

Vol. III. Pl. XLIV. Fig. 1.

Shell imperforate, lenticular, with the upper surface much flattened, acutely carinated; epidermis dark chestnut-color, with minute, hair-like processes lying flat upon the whorls in the direction of their lines of growth, striate; whorls 6, of nearly uniform width, and decreasing very gradually from the aperture to the spire; suture distinct, slightly raised; aperture very narrow; peristome yellowish-white, near its junction with the body-whorl thickened, angulated, and slightly reflected, with a median cleft; parietal wall with a long, yellowish, narrow, projecting tooth, extending from the umbilical axis to the angle of the peristome, and parallel with its thickened edge; base convex, with the umbilical region slightly indented; within the shell, springing from the axis, is a transverse, curved, white tubercle. Greatest diameter 14, lesser 13 mill.; height, 6 mill.

Fig. 189.



S. spinosum.

Caracolla spinosa, Lea, Am. Phil. Trans., IV. 104, Pl. XV. Fig. 35; Obs., I. 114 (1834).

Helix spinosa, Binney, Bost. Journ. Nat. Hist., III. 367, Pl. XI. Fig. 2 (1840); Terr. Moll., II. 153, Pl. XLIV. Fig. 1, excl. syn. — Pfeiffer, Mon. Hel. Viv., I. 421; in Chemnitz, ed. 2, I. 375, Pl. LXV. Figs. 15-17 (1849). — DeKay, N. Y. Moll., 47, Pl. V. Fig. 114 (1843). — Reeve, Con. Icon., 685 (1852). — W. G. Binney, Terr. Moll., IV. 65; L. & Fr.-W. Sh., I. 113, Figs. 189, 190 (1869).

Stenotrema spinosa, Tryon, Am. Journ. Conch., III. 58 (1867).

A species of the Cumberland Subregion, common in East Tennessee, ranging into Alabama and Georgia.

Fig. 189 shows the internal tubercle.

Animal light-colored, head and eye-peduncles darker; foot narrow, translucent, length little more than the diameter of the shell, pointed at the end. Eyes black, eye-peduncles 6 mill. long. Shell carried horizontally on the back.

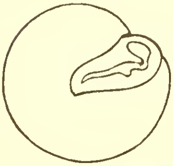
Jaw, as usual, with 8 ribs.

Lingual membrane (Plate VII. Fig. B) with 27—1—27 teeth; 9 perfect laterals; the eleventh tooth has a bifid inner cutting point.

Plate XIV. Fig. H represents the genital system of this species. The penis sac is very long, attenuated at either end, greatly swollen at the median third of its length. The genital bladder is oval, on a short duct.

Stenotrema labrosum, BLAND.

Fig. 190.



S. labrosum, enlarged.

Shell imperforate, lenticular, carinated, the carina somewhat obsolete behind the aperture, solid, with curved striæ, dark-brown colored beneath the epidermis; epidermis thin, with prostrate hairs; spire convex-conoid, obtuse; whorls $5\frac{1}{2}$, rather convex, the last deflexed, constricted, the base inflated, and sculptured beneath the epidermis with numerous impressed spiral lines; the aperture very oblique, narrowly ear-shaped, contracted by a strong linguiform tooth extending along the entire parietal wall; peristome callous, somewhat reflected, the margin joined by a sinuous callus, the basal margin thickened, inwardly much dilated, with a deep and wide notch in the middle; with an internal transverse tubercle on the base of the shell. Greater diameter $12\frac{1}{2}$, lesser 10 mill.; height, $6\frac{1}{2}$ mill.

Helix labrosa, BLAND, Ann. N. Y. Lyc., VII. 430, Pl. IV. Fig. 19 (1861). — W. G. BINNEY, L. & Fr.-W. Sh., I. 113 (1869).

Stenotrema labrosa, TRYON, Am. Journ. Conch., III. 59 (1867).

A species of the Cumberland Subregion, ranging southerly into Alabama, southwesterly into Arkansas.

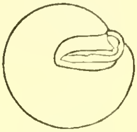
The thickened and reflected peristome, and deep wide notch, sufficiently distinguish *labrosum* from *Edgarianum*. The notch in the latter, situated in the centre of the aperture as in *stenotremum*, is, in a measure, obsolete, but in *labrosum* it is strongly developed, and nearer to the outer edge of the peristome, as in *hirsutum*. The form of the parietal tooth of this species is like that of *hirsutum*, while *Edgarianum* is in that particular more like *stenotremum*. *Edgarianum*, in fact, connects *stenotremum* with *spinosum*, but *labrosum* is rather allied to *hirsutum*, and in the character of the peristome to *maxillatum*.

Jaw with 12 ribs. Lingual membrane with 35—1—35 teeth, 12 of which are laterals. (Pl. XVI. Fig. T.)

Genitalia as in *monodon*.

Stenotrema Edgarianum, Lea.

Fig. 191.



S. Edgarianum, enlarged.

Shell imperforate, lenticular, carinated, solid, arcuately striate, under the epidermis yellowish flesh-color, with distant, short, prostrate hairs; spire convex-conoid, rather obtuse; whorls 5, flattened, the last anteriorly deflected, subconstricted; aperture very oblique, most narrowly ear-shaped, narrowed by a stout, tongue-shaped, arcuately entering tooth on the full length of the parietal wall; peristome subcontinuous, its upper margin subsimple, its basal margin much dilated inwardly, with a slight median cleft; far within on the base of the shell is a stout, transverse tubercle. Greater diameter 9, lesser 8 mill.; height, 5 mill.

Caracolla Edgariana, Lea, Trans. Am. Phil. Soc., IX. 2; Obs., IV. 2 (1843); Proc., II. 31 (1841); in Troschel's Arch. f. Nat., 1843, II. 124.

Helix Edgariana, Pfeiffer, Mon. Hel. Viv., I. 425. — Binney, Terr. Moll., II. 155, Pl. XLIV. Fig. 2. — Reeve, Con. Icon., 703. — W. G. Binney, Terr. Moll., IV. 65; L. & Fr.-W., Sh., I. 114 (1869). — Bland, Ann. N. Y. Lyc., VII. 428, Pl. IV. Fig. 18.

Stenotrema Edgariana, Tryon, Am. Journ. Conch., III. 59 (1867).

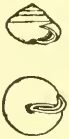
Distribution like *S. labrosum*.

S. Edgarianum differs from *spinosum* in the following particulars: it is smaller, more elevated, and more convex beneath. In form the parietal tooth is most like that of *stenotremum*, while that of *spinosum* is more nearly allied to that usually prevailing in *hirsutum*. The whorls of *spinosum* are flattened and exserted, the carinated edges of all being seen, but in *Edgarianum* the upper whorls are rather convex, and defined by a well-marked suture. Traces of hairs rarely exist at the base of *spinosum*, and no scars indicating their presence are visible on dead or denuded shells, whereas in *Edgarianum* there are distant, short, prostrate hairs, with strongly marked scars on the shell. Fresh or young specimens have, no doubt, the cilia, as in *spinosum*.

Animal not observed.

Stenotrema Edvardsi, Bland.

Fig. 192.



S. Edvarsi.

Shell imperforate, lenticular, carinate, the carina obsolete near the aperture, rather thin, beneath the epidermis pale brown; the epidermis dark chestnut-color, with numerous minute curved hair-like processes lying flat upon, and attached to, the epidermidal surface of the upper whorls in the direction of the incremental striæ, the epidermis at the base covered with acute, raised, transverse tubercles, most numerous, and having erect bristles near the aperture; spire convex-conoid; whorls 5, flattened, gradually increasing, the last gibbous above, suddenly but slightly deflected; apex minutely granulate; base convex, little indented in the umbilical region, and with impressed spiral lines beneath the epidermis; suture deeply impressed; aperture oblique, transverse, auriform, narrowed by a slender, slightly arcuate, lamelliform parietal tooth extending across from the umbilical axis, and terminating with a short angular deflection within the aperture; upper margin of the peristome acute, scarcely reflected, and partially appressed to the body-whorl, with a tooth-like callus within, having an almost obsolete notch in the centre; with an internal transverse tubercle on the base of the shell. Greater diameter 9, lesser 8 mill.; height, 5 mill.

Helix Edvardsi, Bland, Ann. N. Y. Lyc., VI. 277, Pl. IX. Figs. 14–16 (1858). — W. G. Binney, Terr. Moll., IV. 63, Pl. LXXIX. Figs. 7–9; L. & Fr.-W. Sh., I. 115 (1869). — Pfeiffer, Mal. Blätt., 1859, 13.
Stenotrema Edwardsi, Tryon, Amer. Journ. Conch., III. 59 (1867).

Mountains of Fayette or Green Brier County, Virginia; Laurel and Whitly County, Kentucky. A species of the Cumberland Subregion.

This species is allied to, or rather intermediate between, *barbigerum* and *hirsutum*, Say, — the former connecting *spinosum* with *fraternum*. It is smaller, more elevated, less acutely carinated, and readily distinguished from *S. barbigerum* by the partially appressed, notched peristome, and the different character of the epidermis. In *barbigerum* the attached hair-like epidermidal processes are produced, at the sutures and carina, into cilia, which are entirely wanting in this species. The same processes, though less numerous, and sometimes almost obsolete, are observable at the base of the former, while in the latter the basal epidermis approaches in character to that of *Mesodon palliata*. The deep characteristic notch in *S. hirsutum* is considerably less developed in *S. Edvardsi*, and the callus which connects the parietal tooth with the upper margin of the peristome in the former does not exist in the latter. In the general character of the peristome the species under consideration resembles *S. hirsutum*, while *barbigerum* is in that particular more appropriately compared with *fraternum*, Say.

Jaw, as usual, with 13 broad, crowded ribs.

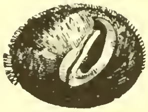
Lingual membrane (Pl. VII. Fig D) with 20—1—20 teeth; 9 perfect laterals; the eleventh tooth has its inner cutting point bifid.

Genitalia not observed.

Stenotrema barbigerum, Redfield.

Shell imperforate, sharply carinate, rather thin, dark horn-colored or brown; the upper surface has the epidermis raised into acute striæ, which at the suture and carina are produced into short cilia or bristles; these epidermidal striæ are sometimes seen beneath, but less distinctly, being often obsolete in the mature shell; basal surface convex, but indented in the umbilical region; spire slightly convex; whorls 5½, rather flat, last one suddenly but slightly deflected; aperture very oblique, transverse, ear-shaped, narrowed by a rather slender, tongue-shaped tooth, which extends nearly across the whole width of the aperture; peristome callous, margins slightly but distinctly reflected, and thickened within; basal margin slightly arcuate, but entire; with an internal transverse tubercle at the base of the shell. Greater diameter 10, lesser 9 mill.; height, 6 mill.

Fig. 193.



S. barbigerum, enlarged.

Helix barbigera, Redfield, Ann. N. Y. Lyc., VI. 171, Pl. IX. Figs. 4, 5, 7 (1856). — Gould in Terr. Moll., III. 21. — W. G. Binney, Terr. Moll., IV. 63, Pl. LXXVII. Fig. 2; L. & Fr.-W. Sh., I. 116 (1869). — Pfeiffer, Mon. Hel. Viv., IV. 348.

Stenotrema barbigera, Tryon, Am. Journ. Conch., III. 60 (1867).

A species of the Cumberland Subregion, ranging into North Carolina, Georgia (Habersham County), and Alabama.

Smaller and more delicate than *S. spinosum;* striæ more numerous, thickly set with fine cilia, which project at the periphery in a fine fringe, and not like short triangular aculei, as in *spinosum*. The umbilical region is less depressed, the parietal tooth much more delicate, and does not overlap the peristome which stands off from the shell, and is not appressed to it. *S. Edgarianum* is much more solid and elevated, has the parietal tooth more developed, the peristome notched, as in *S. hirsutum*, but has about the same diameter.

Jaw, as usual, with 12 crowded ribs.

Lingual membrane (Pl. VII. Fig. C) has 21—1—21 teeth; 8 perfect laterals; but even the third has its inner cutting point greatly produced.

Genitalia as in *S. stenotremum*.

Stenotrema stenotremum, Fér.

Vol. III. Pl. XLII. Fig. 4.

Shell imperforate, globose, diaphanous, reddish, hirsute, convex above, inflated below; spire elevated; whorls 5, somewhat convex, the last anteriorly gibbous, angularly deflected; aperture irregularly transversely lunar, almost linear, contracted by a long, stout, elevated, lamelliform tooth along the whole length of the parietal wall, furnished far within on the base of the last whorl with a transverse tubercle, springing from the axis; peristome scarcely expanded above, thickened by a heavy, regularly curving callus, its basal margin with a small notch. Greater diameter 10, lesser 9 mill.; height, 6 mill.

Helix stenotrema, Férussac in Mus. teste Pfeiffer, Symb., II. 39, excl. *pustula*. — Reeve, Con. Icon., 702. — W. G. Binney, Terr. Moll., IV. 61; L. & Fr.-W. Sh., I. 117 (1869). — Bland, Ann. N. Y. Lyc., VII. 327.

Helix hirsuta, var. *a*, Férussac, Hist., Pl. L. a, Fig. 3. — *β*. Pfeiffer, Mon. Hel. Viv., I. 421; in Chemnitz, ed. 2, I. 376 (1846), Pl. LXV. Figs. 12–14 (1849), var. *stenotrema*. — Var. Binney, Terr. Moll., II. 151, Pl. XLII. Fig. 4. — Deshayes in Fér., I. 140.

Stenotrema convexa, Rafinesque, Enum. and Acc., 3 (1831); Binney and Tryon ed., 28.

Stenotrema stenotrema, Tryon, Am. Journ. Conch., III. 56 (1867).

A post-Pleiocene species, now ranging over both Interior and Southern Regions.

In *stenotremum* the notch is invariably small, and more central than in *hirsutum;* the parietal tooth is more produced over the aperture, and its lower edge is a regular curve, not somewhat sinuous, as in the latter and *spinosum;* it is also curved downwards at its outer extremity, not terminating abruptly, as usual in those species. The form of the parietal tooth, however, varies in *hirsutum*, from which this species can chiefly, if indeed not alone, be distinguished by the size and position of the notch.

Jaw, as usual, with 8 stout, crowded ribs.

Lingual membrane (Pl. VII. Fig. E) has 20—1—20 teeth; 10 laterals; the eleventh tooth having its inner cutting point bifid.

Genitalia as in *S. hirsutum*, with great development of prostate, penis sac, testicle, and epididymis; the last not convoluted.

Stenotrema hirsutum, Say.

Vol. III. Pl. XLII. Fig. 3.

Shell imperforate, subglobose; epidermis brownish or chestnut, covered with numerous, sharp, rigid hairs; whorls 5, rounded; suture distinct; aperture contracted, very narrow, almost closed by an elongated, lamelliform tooth, situated on the parietal wall, and extending from the centre of the base, within the junction of the peristome with the outer whorl, into the edge of the aperture; peristome narrow, very much depressed, and reflected against the outer whorl, with a deep cleft or fissure near the centre of the basal margin; umbilicus wholly covered; base convex; far within the base of the shell is a transverse tubercle, starting from the axis. Greater diameter, 7½, lesser 7 mill.; height, 4 ⅔ mill.

Helix hirsuta, Say, Journ. Phila. Acad., I. 17 (1817); II. 161; ed. Binney, 8. — Binney, Bost. Journ. Nat. Hist., III. 365, Pl. X. Fig. 3 (1840); Terr. Moll., II. 150, Pl. XLII. Fig. 3, excl. *stenotrema*. — DeKay, N. Y. Moll., 36, Pl. III. Fig. 27. — Gould, Invertebrata, 175, Fig. 116 (1841). — Férussac, Tab. Syst., 38; Hist., Pl. L. a, Fig. 1. — Deshayes in Lam., VIII. 113; ed. III. 308; Encyl. Méth., II. 253 (1830); in Fér., I. 140. — Mrs. Gray, Fig. of Moll. An., Pl. CXCIII. Fig. 8, ex Bost. Journ. — Pfeiffer, Mon. Hel. Viv., excl. var., β, I. 421; in Chemnitz, ed. 2, excl. var., I. 374 (1846), Pl. LXV. Figs. 9-11 (1849). — Reeve, Con. Icon., No. 714 (1852). — Leidy, T. M. U. S., I. 257, Pl. XI. Figs. 5, 6 (1851), anat. — W. G. Binney, Terr. Moll., IV. 62; L. & Fr.-W. Sh., I. 118 (1869). — Bland, Ann. N. Y. Lyc., VII. 327. — Morse, Am. Nat. I. 151, Figs. 14, 15 (1867). — Gould and Binney, Inv. of Mass. (2), 417 (1870).

Helix sinuata, γ, Gmelin (teste Pfeiffer).

Helix isognomostomos, γ, Gmelin (teste Pfeiffer).

Triodopsis hirsuta, WOODWARD, Man., Pl. XII. Fig. 7, no desc.

Helix fraterna, WOOD, Index, Suppl. 21, Pl. VIII. Fig. 16 (1828); ed. HANLEY, 126, Fig. 16.

? *Helix porcina*, SAY, Long's Exped. (1824), II. 257, Pl. XV. Fig. 2 (young); BINNEY'S ed., 30, Pl. LXXIV. Fig. 2. — DEKAY, N. Y. Moll., 45 (1843). — PFEIFFER, Mon. Hel. Viv., III. 97. — BLAND, Ann. N. Y. Lyc., VI. 344, with fig. (1858).

Stenotrema hirsuta, TRYON, Am. Journ. Conch., III. 57 (1867).

Animal whitish; head, eye-peduncles, and tentacles slate-color; foot slender, semi-transparent; length less than twice the diameter of the shell, terminating acutely. Cavity of the eye-peduncles apparent, when they are retracted, by two dark lines with a white space between.

A post-Pleiocene species, now found over the Northern and Interior regions as far as Kansas and Virginia, and even into Alabama.

The last whorl in front of the aperture, especially in the larger forms, is more or less angulated, but never carinated. The position of the parietal tooth is often rather oblique, but usually nearly parallel with the peristome, and is more or less distant from it. The nature of the epidermis varies; in some forms the hairs are very numerous, in others comparatively few. Spiral impressed lines sometimes occur beneath the epidermis, at the base of the shell.

Jaw as usual; 8 crowded, broad ribs.

Lingual membrane (Pl. VII. Fig. F) has 22—1—22 teeth; 10 perfect laterals.

Anatomy figured by Leidy (l. c.). Genitalia (Fig. 5). Penis sac long, cylindrical, blunt above, where it receives retractor muscle and vas deferens; genital bladder narrow, elongate-ovate, on a short, narrow duct; the convolution in the epididymis commences near the testicle.

Stenotrema maxillatum, GOULD.

Vol. III. Pl. XL. a, Fig. 2.

Shell imperforate, globose-conic, rather solid, completely covered with short hairs, chestnut-colored; spire convex-conoid, apex obtuse; whorls 5, rather convex, gradually increasing, the last anteriorly deflected, constricted, subinflated below; aperture oblique, linear, almost closed by a broad, jaw-shaped denticle within the peristome; peristome thickened, its terminations joined by a stout, erect parietal callus, the right margin subrectilinear, arched, angularly merging into the very heavy basal margin; within the base of the shell is a transverse tubercle. Greater diameter 7, lesser 6 mill.; height, 5 mill.

Helix maxillata, GOULD, Proc. Bost. Soc., III. 38; in Terr. Moll., II. 157, Pl. XL. a, Fig. 2. — PFEIFFER, Mon. Hel. Viv., III. 126; IV. 164. — W. G. BINNEY, Terr. Moll., IV. 65; L. & Fr.-W. Sh., I. 119 (1869).

Stenotrema maxillata, TRYON, Am. Journ. Conch., III. 57 (1867).

Tennessee, Alabama, Georgia (near Columbus). A species of the Cumberland Subregion.

This is another interesting example of the gradual transition, by almost imperceptible modifications, from one species to another, and of the many changes which are wrought by the varied combination of a few characters signalizing a group. However great its general resemblance to *S. hirsutum* may be, this species is decidedly characterized by the singular jaw-like plate within the fauces.

Animal unobserved.

Stenotrema monodon, Rackett.

Vol. III. Pl. XLI.

Shell imperforate or umbilicated, globose-depressed, diaphanous, reddish horn-colored, covered with short hairs; spire rather convex; whorls 5½, the upper ones flattened, the two last convex, the last anteriorly gibbous, constricted at the aperture; umbilicus more or less opened, or completely closed; aperture widely lunar, somewhat narrowed by a lamelliform tooth on the parietal wall; peristome acute, reflected, thickened with white callus within; a transverse internal tubercle on the base of the shell. Greater diameter 11, lesser 10 mill.; height, 6 mill.

Helix monodon, Rackett, Linn. Trans., XIII. 42, Pl. V. Fig. 2 (1822); ed. Chenu, 269, Pl. XXVII. Fig. 5. — Wood, Ind. Supplem., Pl. VII. Fig. 15 (1828); ed. Hanley, 226, Fig. 15. — Binney, Bost. Journ. Nat. Hist., III. 360, Pl. X. Fig. 1 (1840); Terr. Moll., II. 147, Pl. XLI. lower Figs.[1] — Gould, Invertebrata, 174, Fig. 113 (1841). — Adams, Vermont Mollusca, 159 (1842). — W. G. Binney, Terr. Moll., IV. 60; L. & Fr.-W. Sh., I. 120 (1869). — Gould & Binney, Inv. of Mass., ed. 2, 419 (1870). — DeKay, N. Y. Moll., 35, part, excl. syn., Pl. III. Fig. 19, not Fig. 21, a, b (1843). — Mrs. Gray, Fig. Moll. An., Pl. CXCIII. Fig. 11 (ex. Bost. Journ., no desc.). — Billings, Canadian Nat., II. 100 Fig. 6 (1857). — Morse, Amer. Nat., I. 151, Figs. 12, 13 (1867). — Pfeiffer, Mon. Hel. Viv., IV. 320.

Helix convexa, Chemnitz, part (excl. syn., et tab. LXVI. Figs. 24, 27), Pl. X. 17, 18. — Pfeiffer, Mon. Hel. Viv., III. 268 (excl. β et γ). — Deshayes in Lam., VIII. 112; 3d ed., III. 308; Encycl. Méth., II. 253 (1830); in Fér. l. c., I. 144. — Reeve, Con. Icon., 696 (1852), excl. syn.; No. 717 (1854).

Helicodonta hirsuta, *a*, Férussac, Tabl. Syst., 101, no desc.

Stenotrema monodon, Morse, Journ. Portl. Soc., I. 10, Fig. 13, Pl. II. Fig. 2; Pl. IV. Fig. 14 (1864). — Tryon, Am. Journ. Conch., III. 56 (1867).

VAR. FRATERNA.

Helix fraterna, Say, Long's Exp., II. 257, Pl. XV. Fig. 3; Binney's, ed. 30, Pl. LXXIV. Fig. 3. — Mrs. Gray, Fig. Moll. An., Pl. CXCIII. Fig. 5, no descr. — Binney, Bost. Journ. Nat. Hist., III. 363, Pl. X. Fig. 2, not of Wood.

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[1] The specimen figured is abnormal in not having a parietal tooth.

Helix monodon, DeKay, N. Y. Moll. l. c., ex parte, Pl. III. Fig. 21, a, b (1843). — Wood, Ind. Suppl., Pl. VII. Fig. 15.

Helix convexa, Chemnitz, ed. 2, I. 86, ex parte. — Var. Reeve, Con. Icon. l. c. — *β*, Pfeiffer, Mon. Hel. Viv., I. 420.

Helix monodon, *β*, Pfeiffer, l. c., IV. 320.

VAR. LEAII.

Helix convexa, *γ*, Pfeiffer, l. c. — Var. Chemnitz, l. c., Pl. LXVI. Figs. 24, 25.

Helix monodon, *γ*, Pfeiffer, IV. 320. — Part Binney, Terr. Moll., Pl. XLI. central figures.

Helix Leaii, Ward, MS. teste Binney.

——— Lister, Syn. Conch., Pl. XCIII. Fig. 94.

In the post-Pleiocene of the Mississippi Valley; now found in Canada and all the Eastern Province to Texas.

Animal yellowish-brown, darker on the head, neck, eye-peduncles, and tentacles. Foot narrow, cylindrical, one and a half times as long as the diameter of the shell, terminating in a point. Eye-peduncles one fourth of an inch long. Eyes black. Some individuals much darker than others (see B. J. N. H., I. Pl. X).

The varieties of this shell present remarkable differences in size and coloring, and in the form of the umbilicus. The transverse diameter varies from one sixth to three sixths of an inch, and the form from subglobular in small specimens to a very flattened shape in the larger. The coloring exhibits every shade, from light amber to dark chestnut, sometimes with a revolving band, and then known as var. *cincta*.[1] The whorls of some revolve about the axis at such a distance as to leave a deep and wide umbilicus (*monodon*); while in others they are in such near approximation as to permit only a small perforation, which the narrow, reflected peristome is sufficiently wide to cover (*fraternum*). The hairy projections of the epidermis are most distinct upon the young shells, but are often wanting at every stage of growth. The oblique striæ are so fine as hardly to be visible, and in some instances the shell appears to be glabrous. Very beautiful specimens, about one fourth of an inch in diameter, with a dark, shining epidermis and open umbilicus, occur in Ohio, Indiana, Iowa, and Michigan. They are more convex, and as the same number of volutions is contained in half the space, they *appear* to have more whorls than the common variety. Some persons have considered these to form a distinct species (*H. Leaii*, Ward, MS.); but I do not see that they can, with propriety, be separated.

In the Western States this species is generally found in the forests. In New Hampshire and Vermont it is also found in forests with other species, but more commonly in hillside pastures, under flat stones, a situation where other species rarely occur. Two individuals are commonly found together.

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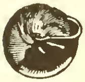
[1] Hayesville, North Carolina. See Lewis, Proc. Phila. A. N. S., 1874, p. 162.

Fig. 194 is drawn from a curious pathological specimen. The peristome having been broken after the animal's arrival at maturity, a new peristome has been formed somewhat in the rear of the first, and a new parietal tooth added. The base of the shell was purposely broken to show the position of the internal tubercle.

Fig. 194.



S. monodon.

The jaw of *S. monodon* is slightly arcuate, stout, bluntly rounded at ends; anterior surface with broad. stout ribs denticulating each margin (Fig. 188).

H. monodon (Pl. VII. Fig. H) has 21—1—21 teeth on its lingual membrane; 10 perfect laterals; the thirteenth tooth has a bifid inner cutting point. Morse gives 28—1—28 teeth.

The characteristic feature of the genitalia is the penis sac. It is unproportionally long, club-shaped, and greatly enlarged above, where it receives both vas deferens and retractor muscle. The genital bladder is small, elongate-oval, on a short, delicate duct. The epididymis is convoluted in its whole length (Pl. XI. Fig. L).

Stenotrema germanum, Gould.

Vol. III. Pl. XL. a, Fig. 3.

Shell imperforate, solid, depressed, low-conical above, convex beneath, slightly angular at periphery, covered with a scabrous rusty horn-colored epidermis, beset with scattered hairs; whorls 5½, closely revolving, separated by a well-impressed suture; aperture lunate, the basal portion being but slightly curved, and turning upward at a rather sharp angle; peristome incumbent, with a deep stricture behind it, moderately reflexed, roseate; on the parietal wall of the aperture is a distinct, oblong, erect, white tooth, not connected with either extremity of the peristome. Greater diameter, 7½ mill.; height, 5 mill.

Helix germana, Gould, U. S. Expl. Exped. Moll. (1852), 70, Fig. 40, a, b, c; Terr. Moll., II. 156, Pl. XL. a, Fig. 3. — Pfeiffer, Mon. Hel. Viv., III. 269. — W. G. Binney, Terr. Moll. U. S., IV. 11; L. & Fr.-W. Sh., I. 120 (1869).
Stenotrema germana, Tryon, Am. Journ. Conch., III. 58 (1867).

Oregonian region at Astoria.

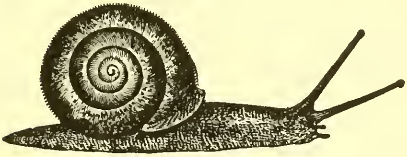
Jaw more resembling the type usual in the subgenus *Stenotrema* than *Mesodon*, the ribs, 11 in number, being broad and crowded. There are forms of *germana* closely connecting the species with *Mesodon Columbianum*, Lea. I have, while treating the latter species (see below), pointed out the decided specific differences shown in the jaw and genitalia; at the same time I have stated that by the want of the internal tubercle, *germanum* is more nearly allied to *Mesodon* than to *Stenotrema*.

S. germanum (Pl. VII. Fig. G) has 28—1—28 teeth; 12 perfect laterals. The left-hand figure shows one of the few marginals which have the outer cusp bifid.

TRIODOPSIS, Raf.

Animal heliciform, mantle posterior, other characters as in *Patula*, q. v.

Fig. 195.

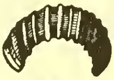


Animal of *T. palliata.*

Shell imperforate or umbilicated, orbicularly depressed or subglobose; more or less obliquely striated; whorls 5 – 7, the last somewhat deflexed in front; aperture sinuously coarctate, subtriangular; peristome white, thickened, broadly and angularly reflexed, usually dentate; parietal wall of the aperture with a strong, obliquely entering denticle.

The subgenus inhabits almost exclusively North America, especially the Eastern Province. Two Central American species have, however, been described, and one European species, *personata*, Lam. This last is said by Moquin-Tandon to have 3 – 5 separated ribs upon its jaw, while our American species, as shown above, have numerous ribs.

Fig. 196.



Jaw of *T. appressa.*

Jaw stout, arcuate, low, wide, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous decided, separated ribs, denticulating either margin. There are about 15 in *palliata;* 10 in *obstricta;* 15 in *appressa;* 14 in *inflecta;* 10 in *Rugeli;* 14 in *fallax;* over 10 in *Hopetonensis;* 17 in *Van Nostrandi;* 14 in *introferens;* over 12 in *Harfordiana vultuosa;* 11 in *loricata;*[1] over 10 in *tridentata.* I have not examined *H. Mullani.*[2]

Triodopsis does not differ from *Mesodon* or *Polygyra* in the character of its jaw. *Stenotrema*, on the other hand, is readily distinguished by having the ribs broader and more crowded on its jaw.

The general arrangement of the teeth on the lingual membrane is as in *Patula.* The characters of the individual teeth are given on Plate VII. I have selected *appressa* (Pl. VII. Fig. Q) to show these characters, comparing the dentition of the other species with it. The centrals are longer than wide; the base of attachment has its outer, lower, lateral expansion but little developed, its lower margin incurved, its upper margin squarely reflected; the reflection is stout, with subobsolete side cusps, but well-developed side cutting points, and a stout, short median cusp, bearing a cutting point which does not reach the lower margin of the base of attachment. The laterals are like the centrals, but, as usual, asymmetrical by the suppression of the inner, lower, lateral expansion of the base of attachment and the inner side cusp with its cutting point. The transition teeth are characterized by the gradual lesser proportional development of the reflection, and greater development of the inner cutting point; as the teeth pass outward, this point becomes bifid, the reflection becomes gradually shorter, until the true marginals are reached. These last are low, wide, the reflection equalling the base of attachment, the inner cutting point being greatly developed, long, oblique, bluntly bifid, and the inner bifurcation the shorter of the two; the outer cusp is very short, blunt, sometimes also bifid. In this species the tenth is the first lateral showing decided modification; the fourteenth tooth has its inner point bifid; the seventeenth tooth is a decided marginal. The transition from laterals to marginals is so gradual that it is often difficult to give the number of perfect laterals. In many cases, therefore, the number given by me must be considered as only approximately correct. There is great variation in the denticulation of the marginal teeth.

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[1] The ribs are more crowded in this species.

[2] Probably identical wit *devia.*

The general character of the dentition of the other species is about the same as in *appressa.* I found great difficulty in detecting the side cutting points in several species, especially *tridentata* and *palliata.* In some species I did not find the transition teeth or inner marginals with bifid cutting point. *Helix personata* is the only European species of this subgenus, but no figure of its dentition has been published to compare with that of our species. The same is true of the two Central American species known.

Triodopsis palliata, SAY.

Vol. III. Pl. XIV.

Shell with the umbilicus closed, thin, depressed; epidermis dark brown or chestnut-color and rough with minute, acute projections and stiff hairs; whorls 5, flattened above and rounded below, with numerous very fine, oblique striæ; aperture three-lobed, much contracted by the peristome and teeth; peristome white, sometimes edged with brown, widely reflected, with two projecting teeth on the inner margin, the one near its junction with the body-whorl acute and prominent, the other, on the basal portion, long, lamellar, and but little prominent; parietal wall with a very prominent, white, curved tooth, projecting nearly perpendicularly from the shell, and forming one boundary of the aperture; umbilicus covered with a white callus, the continuation of the reflected peristome; base convex. Greater diameter 21, lesser 18 mill.; height, 10 mill.

Helix palliata, SAY, Journ. Phila. Acad., II. 152 (1821); BINNEY's ed. 10. — BINNEY, Bost. Journ. Nat. Hist., III. 353, Pl. VII. (1840); Terr. Moll., II. 136, part, Pl. XIV. — ADAMS, Vermont Mollusca, 159 (1842). — LEIDY, T. M. U. S., I. 253, Pl. VII. Fig. 8 (1851), anat. — DEKAY, N. Y. Moll., 33, Pl. III. Fig. 36 (excl. a, b) (1843), excl. syn. pars. — PFEIFFER, Mon. Hel. Viv., I. 316; in CHEMNITZ, ed. 2, I. 359, Pl. LXII. Figs. 15, 16 (1849). — MRS. GRAY, Fig. Moll. An., Pl. CXCIII. Fig. 8, ex Bost. Journ. (no descr.). — DESHAYES in FÉR., I. 144 (excl. var.). — REEVE, Con. Icon., No. 678. — W. G. BINNEY, Terr. Moll., IV. 56; L. & Fr.-W. Sh., I. 124 (1869). — BLAND, Ann. N. Y. Lyc., VII. 441. — MORSE, Amer. Nat., I. 150, Figs. 10, 11 (1867). — GOULD and BINNEY, Inv. of Mass., ed. 2, 420 (1870).

Helix denotata, Férussac, Tab. Syst., 38 (1822), no descr. ; Hist., Pl. XL. a, Fig. 5 ; Pl. L. a, Fig. 7. — Deshayes in Lam., VIII. 115 ; ed. 3, III. 309.
Helix notata, Deshayes, Encycl. Méth., II. 224 (1830).
Xolotrema palliata, Tryon, Am. Journ. Conch., III. 49 (1867).

A post-Pleiocene species, now found in the Northern and Interior Regions; from Canada to Georgia, and Louisiana.

Animal of a uniform, blackish slate-color over the whole upper surface; foot narrow, in length double the diameter of the shell, and terminating in an acute point; eye-peduncles one third of an inch long; eyes not distinguishable from the general color (see p. 301).

The nature of the epidermis and sculpturing are the only constant specific characters which distinguish *palliata* from *obstricta*. In the former the epidermis has "numerous minute tuberculous acute prominences"; the striæ are close together, and somewhat irregular in development. In the typical form the whorls are convex, with a well-impressed suture; the last whorl is obtusely angulated in front of, but not behind the aperture.

The species varies in the form of the whorls and extent of the angulation of the periphery, as follows : —

Var. *β*. — Whorls flattened above, slightly exserted, the last more sharply angulated in front of the aperture, with the striæ, especially behind the aperture, more distinctly defined. Greater diameter 22, lesser 19½ mill.; height, 8½ mill. (5 whorls.) Kentucky and Tennessee.

Var. *γ*. — Whorls planulate above, and so exserted as to show the carinated edges of all excepting the apicial whorls, the last whorl with an acute projecting carina continued to the back of the aperture; the umbilicus not always entirely covered by the reflected lip. Greater diameter 21½, lesser 18½ mill.; height, 7 mill. (5 whorls.) Tennessee.

The lingual membrane (Pl. VII. Fig. O) has 34—1—34 teeth; 12 perfect laterals; another specimen had 14 laterals. Morse counted 115 rows of teeth. The inner cutting point of the transition teeth in this species is very large, as shown in *c*.

Jaw as usual, with more than 15 ribs.

Genitalia figured by Leidy, l. c. The genital bladder is very elongate-ovate, on a duct of about equal length, swelling to equal size as it approaches the vagina; the penis sac is short, cylindrical, with a constriction at its upper part, beyond which it tapers slightly, and receives the vas deferens at its apex; the retractor muscle is inserted in the vas deferens near its junction with the penis sac; the vas deferens near the prostate gland is swollen into a small bulb-like expansion; the same is seen in *T. obstricta*.

Triodopsis obstricta, Say.

Vol. III. Pl. XV.

Shell with the umbilicus closed, depressed, with heavy, rib-like striæ, and interstitial, minute, revolving lines, reddish horn-color; spire flattened; whorls 5, depressed, the last convex below, with a prominent, acute carina above; aperture oblique, subtriangular, narrowed by a tongue-shaped, arcuately entering tooth on the parietal wall; peristome thin, broadly expanded, its inner edge with a heavy thickening of white callus, its right portion with a stout, erect denticle, its basal portion straight, dilated, reflected, with a long, lamellar, less prominent denticle. Greater diameter 26, lesser 22 mill.; height, 11 mill.

Helix obstricta, SAY, Journ. Phila. Acad., II. 154 (1821); BINNEY'S ed. 17. — PFEIFFER, Mon. Hel. Viv., I. 317. — REEVE, Con. Icon., No. 683 (1852). — W. G. BINNEY, Terr. Moll., IV. 57; L. & Fr.-W. Sh., I. 125 (1869). — BLAND, Ann. N. Y. Lyc., VII. 446.

Helix palliata, var. a, SAY, Journ. Phila. Acad., II. 152; BINNEY'S ed. 16. — Var. a, b, DEKAY, N. Y. Moll., 33, Pl. II. Fig. 16 (1843). — Var. BINNEY, Terr. Moll., II. 137, Pl. XV.

Helix appressa, var. DESHAYES in FÉR. (in plate, not in text).

Helicodonta denotata, var., FÉRUSSAC, Tab. Syst., 38; Hist., Pl. L. A, Fig. 7, no descr.

Caracolla helicoides, LEA, Trans. Am. Phil. Soc., IV. 103, Pl. XV. Fig. 34; Obs. I. 113 (1834).

Helix Caroliniensis, LEA, Trans. Am. Phil. Soc., IV. 108, Pl. XV. Fig. 33; Obs. I. 112 (1834).

Xolotrema obstricta TRYON, Am. Journ. Conch., III. 49 (1867).

A post-Pleiocene species (Natchez Bluff), now found in the Interior Region, in Ohio, Indiana, Tennessee, Georgia, South Carolina.

T. obstricta differs from *T. palliata* in the following particulars: the epidermis is free from "tuberculous prominences," but has raised spiral lines between the costæ, on the upper and lower surface of the shell. It has elevated rigid, distant costæ, the whorls are subexserted and acutely carinated, the carina of the upper whorls compressed, and overlapping the sutures, as in *Patula Cumberlandiana*. The umbilicus, as in the most carinated form of *T. palliata*, is not always entirely covered by the reflected peristome.

Var. β. — Whorls subexserted, carina less acute and prominent, partially obsolete behind the aperture, not covering the sutures. Greater diameter 24, lesser 19 mill.; height, 8 mill. (5 whorls.) Columbus, Georgia. This variety connects *T. Caroliniensis* with *T. obstricta*, and is generally found in cabinets under the former name.

Var. γ. — Whorls more convex, the last obtusely angulated in front of, but very little behind the aperture. Greater diameter 21, lesser 17 mill.; height, 7½ mill. (5 whorls.) South Carolina. This is the typical *T. Caroliniensis*, holding precisely the same relation to *obstricta* as *palliata* to *palliata* var. γ. Also found in Tennessee and Georgia.

Jaw as usual; over 10 ribs.

Lingual membrane (Pl. VII. Fig. P) has 33—1—33 teeth; 10 perfect laterals; very like *T. palliata*. My figures are drawn from that part of the lingual membrane which has the cutting points of its teeth quite blunt. Other portions of the membrane would furnish much more sharply pointed teeth.

The genital system resembles exactly that of *T. palliata*, Say, as figured by Dr. Leidy, Vol. I. Pl. VII. Fig. 8. (See above.)

Triodopsis appressa, Say.

Vol. III. Pl. XIII.

Shell with the umbilicus covered, orbicularly depressed, pellucid, with rib-like striæ and minute revolving lines, reddish horn-colored; spire flattened; whorls 5, flattened above, the last obtusely angular (the angle obsolete anteriorly); aperture oblique, compressed, subtriangular; peristome angularly broadly reflected, thickened within, its terminations joined by a thin callus, on which is an obliquely entering, erect, curved, tongue-shaped tooth, the basal margin with a lamellar-like, long denticle, the right margin sometimes with an erect tooth-like callus. Greater diameter 18, lesser 15 mill.; height, 8 mill.

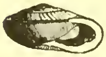
Helix appressa, Say, Journ. Phila. Acad., II. 151 (1821); ed. Binney, 15. — Binney, Bost. Journ. Nat. Hist., III. 356, Pl. VIII (1840); Terr. Moll., II. 140, Pl. XIII. — DeKay, N. Y. Moll., 27, Pl. II. Fig. 11 (1843). — Pfeiffer, Mon. Hel. Viv., I. 317; in Chemnitz, Conch., 2d ed., I. 361, t. LXIII. Figs. 17, 18. — Reeve, Con. Icon., No. 689. — Deshayes in Fér., Hist., I. 141. — W. G. Binney, Terr. Moll., IV. 59; L. & Fr.-W. Sh., I. 126, Fig. 211 (1869). — Bland, Ann. N. Y. Lyc., VII. 432.

Helix linguifera, Lamarck, An. s. Vert., VI. 90 (1822). — Féeussac, Prodr., 95; Hist., Pl. XLIX. a, Fig. 3. — Deshayes, Encycl. Méth., II. 224 (1830); in Lam., VIII. 70; ed. 3, III. 293. — Pfeiffer, Symb. ad Hist. Hel., 19 (no descr.). — Chenu, Ill. Conch., Pl. XII. Fig. V; Pl. VII. Fig. 6. — Delessert, Recueil, Pl. XXVI. Fig. 5 (1841).

Xolotrema appressa, Tryon, Am. Journ. Conch., III. 50 (1867).

In Pennsylvania and New York it is not found east of the Appalachian Chain. From thence it ranges to Arkansas, and from Georgia to Illinois. It may thus be considered a species of the Interior Region. It is best developed in Tennessee and Georgia.

Fig. 197.

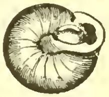


T. appressa.

Animal resembling, externally, *T. palliata*.

Fig. 197 represents a smaller, more angular form. Fig. 198 represents the var. *a* of Say, which has two well-developed teeth on the peristome. I have received it from Virginia, Tennessee, Kentucky, Ohio, Indiana, and Illinois.

Fig. 198.



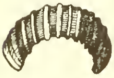
T. appressa, var. *a*.

The jaw is very strongly arcuate, of uniform width throughout; anterior surface with 15 ribs, denticulating both margins.

Lingual membrane with 105 rows of 40—1—40 teeth each; another membrane (Pl. VII. Fig. Q) had 33—1—33 teeth; about 12 perfect laterals. The fourteenth tooth has a bifid inner cutting point.

I have in my cabinet a reversed individual, of var. a, found in my garden in Burlington, New Jersey. It is a descendant of some Illinois specimens, sent me many years ago by the lamented Kennicott. The adaptation of the species to colonization is also proved by its having recently been found by Mr. J. Matthew Jones in the island of Bermuda, no doubt imported on plants.

Fig. 199.



Jaw of *T. appressa.*

The genitalia are figured on Pl. XI. Fig. K. The ovary is long and narrow. The epididymis is very long, convoluted at the end nearer the oviduct. The last-named organ is not much convoluted. The prostate is scalloped along its edges. The genital bladder is globular, small, with a long, small duct. The sac of the penis is extremely long, ribbon-like, one and one half times as long as the oviduct. The vas deferens enters its apex.

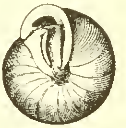
The long ribbon-like sac of the penis resembles that figured by Dr. Leidy of *Mesodon Sayii.* There is but little resemblance to the genitalia of *T. palliata*, so nearly allied by its shell.

Triodopsis inflecta, Say.

Vol. III. Pl. XLV. Figs. 2, 3.

Shell with the umbilicus closed, depressed; epidermis brownish horn-color, with very fine, hair-like projections; whorls 5, with very minute transverse striæ; suture not much impressed; aperture three-lobed, very much contracted; peristome white, narrow, reflected, with a deep groove or indentation behind the reflection, contracting the opening so that the outer edge of the peristome does not project beyond the surface of the whorl; on the inner margin of the peristome are two acute teeth, with the points directed inwards, one near the base, the other midway between that and the junction of the peristome with the body-whorl, with a circular sinus between them, forming one of the lobes of the aperture; parietal wall with a long, arcuated, white tooth; umbilicus covered, its place considerably impressed. Greater diameter 12, lesser 11 mill.; height, $6\frac{2}{3}$ mill.

Fig. 200.



T. inflecta.

Helix inflecta, Say, Journ. Phila. Acad., II. 153 (1821); ed. Binney, 16. — Binney, Bost. Journ. Nat. Hist., III. 358, Pl. IX. Fig. 1 (1840); Terr. Moll., II. 143, Pl. XLV. Figs. 2, 3. — DeKay, N. Y. Moll., 45 (1843). — Mrs. Gray, Fig. Moll. An., Pl. CXCIII. Fig. 7 (ex Bost. Journ., no descr.). — W. G. Binney, Terr. Moll., IV. 59; L. & Fr.-W. Sh., I. 128, Fig. 216 (1869). — Bland, Ann. N. Y. Lyc., VII. 425. — Pfeiffer, Mon. Hel. Viv., IV. 319.

Helix clausa, Férussac, Tab. Syst., 38, No. 104; Hist., Pl. LI. Fig. 2. — Deshayes, Encycl. Méth., II. 252 (1830); in Lamarck, VIII. 114; ed. 3, III. 309; in Fér., I. 143. — Pfeiffer, Mon. Hel. Viv., I. 420; in Chemnitz, 2d ed., I. 368, t. LXIV. Figs. 25, 26. — Reeve, Con. Icon., No. 704 (1852).

Xolotrema clausa, RAFINESQUE, Enumeration, &c., 3 (1831); ed. BINNEY and TRYON, 68.

Isognomostoma inflecta, TRYON, Am. Journ. Conch., III. 54 (1867).

A Post-pleiocene species, now found in the Interior Region, from Texas to the Appalachian Chain in Pennsylvania and New York; from Sea Islands of Georgia through the Northwestern States.

The large specimen figured on p. 306 is from University Place, Tennessee, where the species seems most developed.

Animal dark bluish slate-color; head, eye-peduncles, and tentacles almost black; eye-peduncles long and slender; foot narrow, in length more than twice the diameter of the shell, terminating in an acute angle (see Bost. Journ. N. H., I. Pl. IX.).

Jaw thick, short, broad, arched, of almost uniform width quite to the blunt ends; with 14 stout, crowded ribs, visible on both anterior and posterior surface and denticulating either margin.

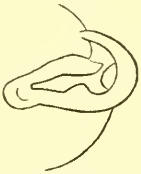
T. inflecta (Pl. VII. Fig. S) has 22—1—22 teeth on its lingual membrane; 7 perfect laterals. This and the following species have inner marginal teeth, with simple, not bifid, cutting points (*c*). It was bifid in the twenty-first tooth of one specimen examined, simple in the twenty-second, and bifid in the twenty-third, and all beyond. There were over 23—1—23 teeth on this membrane.

Genitalia as in *T. Rugeli.*

Triodopsis Rugeli, SHUTTLEWORTH.

Shell imperforate, orbicularly convex, with granulate striations and few hairs, waxen horn-color; spire short, obtuse; whorls 5½, rather convex, the last suddenly falling in front, and strongly contracted at the aperture; aperture depressed, narrowed by a tongue-shaped, flexuose, strong, parietal denticle; peristome reflected, within thickened, its right termination with a large, obtuse, very deeply seated tooth (whose position is marked on the exterior of the shell by a groove or pit), the basal terminus furnished with a smaller, transverse, submarginal denticle. Greater diameter 13, lesser 11½ mill.; height, 6¼ mill.

Fig. 201.



T. Rugeli, enlarged.

Helix Rugeli, SHUTTLEWORTH, Bern. Mittheil., 1852, 198. — PFEIFFER, Mon. Hel. Viv., III. 268. — GOULD in Terr. Moll., III. 18.— W. G. BINNEY, Terr. Moll., IV. 60, Pl. LXXVIII. Fig. 15; L. & Fr.-W. Sh., I. 129 (1869). — BLAND, Ann. N. Y. Lyc., VII. 426.

Isognomostoma Rugeli, TRYON, Am. Journ. Conch., III. 55 (1867).

Tennessee, North Carolina, Whitley County, Kentucky. A species of the Cumberland Subregion.

It is in most respects similar to the preceding species, and would be mistaken for it unless the aperture be examined. The position of the upper tooth of the peristome far within the aperture at once distinguishes it. The size is not, however, any criterion, as I have individuals of *Rugeli* only 10 millimetres in diameter, while some of my specimens of *inflecta* are full 13 millimetres.

The figure shows an enlarged view of the aperture.

Animal externally resembling that of *T. inflecta.*

Jaw as usual; about 10 ribs.

Lingual membrane (Pl. VII. Fig. K) has 21—1—21 teeth; 6 perfect laterals. The inner laterals (eighth to tenth tooth) have a simple inner cutting point; beyond this it is bifid.

Genitalia (Pl. XV. Fig. E) generally resembling those of *tridentata*, but distinguished by the genital bladder, which is small, globular, on a duct of equal width throughout its course, not swelling as it approaches the vagina.

Triodopsis tridentata, Say.

Vol. III. Pl. XXVII.

Shell umbilicated, orbicularly depressed, with crowded rib-like striæ, light-horn or chestnut colored; spire very short; whorls 5½, rather convex, the last scarcely deflected in front; aperture lunar, subtriangular; peristome white, reflected, its outer contour rounded, thickened within, its terminations converging, joined by a light deposition of callus bearing a tongue-like, erect, entering tooth, both the right and basal portions bearing on the inner margin a stout, acute denticle. Greater diameter 16, lesser 14 mill.; height, 8 mill.

Helix tridentata, Say, Nich. Encycl., Pl. II. Fig. 1 (1817-1819); Binney's ed., 6, Pl. LXX. Fig. 1. — Eaton, Zoöl. Text-Book, 193 (1826). — Férussac, Tab. Syst., 38; Hist., Pl. LI. Fig. 3. — Wood, Ind. Supplem., 21, Pl. VII. Fig. 2 (1828); ed. Hanley, 226, Fig. 11. — Deshayes, Encycl. Méth., II. 213 (1830); in Lam., VIII. 115; ed. 3, 309; in Fér. l. c., I. 72. — Binney, Bost. Journ. Nat. Hist., III. 382, Pl. XVII (1840), part; in Terr. Moll., II. 183, Pl. XXVII. — DeKay, N. Y. Moll., 28, Pl. II. Fig. 7 (1843). Adams, Vermont Mollusca, 160 (1842). — Gould, Invertebrata, 173, Fig. 115 (1841). — Pfeiffer, Mon. Hel. Viv., I. 412; in Chemnitz, 2d ed., I. 84, Pl. X. Figs. 7, 8. — Potiez et Michaud, Gal., I. 114. — Mrs. Gray, Fig. Moll. An., Pl. CCXCI. Fig. 3 (ex Bost. Journ., no descr.). — Reeve, Con. Icon., No. 690 (1852). — W. G. Binney, Terr. Moll., IV. 70; L. & Fr.-W. Sh., I. 129 (1869). — Bland, Ann. N. Y. Lyc., VII. 423. — Morse, Amer. Nat., I. 150. Figs. 8, 9 (1867). — Gould and Binney, Inv. of Mass., ed. 2, 422 (1870).

Triodopsis lunula, Rafinesque, En. and Acc., 3; ed. Binney and Tryon, 68.

Triodopsis tridentata, Tryon, Am. Journ. Conch., III. 50 (1867).

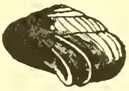
—— Lister, Pl. XCII. Fig. 92.

From Canada through all Eastern North America. A species of the Eastern Province.

A curious pathological specimen, with a double peristome, is figured on p. 309

Animal dark bluish slate-color, deeper on the head, eye-peduncles, and ten tacles; length of eye-peduncles about a quarter of an inch; foot narrow, equal in length to nearly twice the diameter of the shell, terminating in an acute angle (see B. J. N. H., I. Pl. XVII.).

Fig. 202.



T. tridentata, deformed.

Jaw as usual; over 10 ribs.

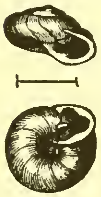
The lingual membrane (Pl. VII. Fig. M) has 25—1—25 teeth; 10 laterals. The inner cutting point is bifid after the tenth tooth.

Genitalia (Pl. XV. Fig. D). The penis sac is long, cylindrical, receiving the vas deferens and retractor muscle at its summit; genital bladder small, globular, with a long duct, which is narrow above, but below its middle gradually enlarges to greater than the width of the bladder. The details of the size of the genital bladder and its duct seem to offer an excellent specific character to the members of this group of *Triodopsis*

Triodopsis Harfordiana, J. G. COOPER.

Shell umbilicated, depressed-globose, thin, surface scarcely broken by incremental wrinkles, horn-colored; spire slightly elevated, apex obtuse; whorls 4, convex, suture impressed, the last globose below; aperture oblique, lunate, trilobed, one tooth on the parietal wall, and two on the reflected peristome; peristome white, broad, reflected, with a toothlike process near either termination. Greater diameter 9, lesser 6 mill.; height, 3 mill.

Fig. 203.



T. Harfordiana.

Helix Harfordiana, J. G. COOPER, Amer. Journ. Conch., V. 196, Pl. XVII. Fig. 3 (1870).

In the Californian province, in Fresno County, "Big Trees," latitude 37°, 6,500 feet altitude. In the Central Province at Salmon River, Idaho.

Jaw as usual; ribs over 12.

Lingual membrane (Pl. VII. Fig. R) as usual in the genus. Teeth 26—1—26, with 12 laterals. The side cutting points to central and lateral teeth are well developed.

Triodopsis fallax, SAY.

Vol. III. Pl. XXVIII.

Shell umbilicated, depressed-globose, with rib-like striæ, reddish horn-colored; spire convex; whorls 6, rather convex, the last deflected anteriorly, constricted; aperture trilobed, contracted by a large, oblique, tongue-shaped, arcuately entering tooth on the parietal wall; peristome reflected, thickened within, white, with 2 teeth, the upper one bending inward not on the edge, the other subbasal. Greater diameter 13, lesser 11 mill.; height, 7½ mill.

Helix fallax, SAY, Journ. Phila. Acad., V. 119 (1825); BINNEY's ed., 27. —DEKAY, N. Y. Moll., 28, Pl. III. Fig. 23 (1843). — PFEIFFER, Mon. Hel. Viv., I.

412; in CHEMNITZ, ed. 2, I. 364, Pl. LXIV. Figs. 7-9. — REEVE, Con. Icon., No. 686 (1852). — W. G. BINNEY, L. & Fr.-W. Sh., I. 131 (1869).

Helix tridentata, BINNEY, Pt. Bost. Journ. Nat. Hist., III. 382, Pl. XVIII. Fig. 3 (1840); Terr. Moll., II. 183, Pl. XXVIII. — W. G. BINNEY, Terr. Moll., IV. 72.

Triodopsis fallax, TRYON, Amer. Journ. Conch., III. 51 (1867).

From Canada to Texas and Florida, all over the Eastern Province.

Nearly allied to *T. tridentata*, but in this the spire is more elevated, and sometimes has 6 full volutions. There is a deep groove behind the peristome, contracting the aperture; the peristome is widely reflected, and directed inwards, forming a basin-shaped mouth; the upper tooth on the peristome is broader, sometimes bifid, and even trifid, and very much inflected; the parietal tooth extends quite to the base of the shell, and unites with the extremity of the peristome; the aperture is nearly filled up by the teeth and the contraction of the peristome.

Animal as in *T. tridentata* (see B. J. N. H., I. Pl. XVIII.).

Jaw as usual in the genus; 14 ribs.

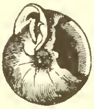
Lingual membrane (Pl. VII. Fig. L) has about 40—1—40 teeth; 12 perfect laterals. This (not *tridentata*) had no bifurcation to the inner cutting point of the transition teeth (thirteenth and fourteenth teeth), at least on the portion of the membrane examined by me.

Genitalia (Pl. XV. Fig. B) as in *tridentata*, but the duct of the genital bladder is of equal size throughout its length, — an unimportant, even if constant difference.

Triodopsis introferens, BLAND.

Shell umbilicate, globose, depressed, thin, with rib-like striæ, yellowish horn-colored; spire convex; whorls 6, moderately convex, the last scarcely descending, much constricted at the aperture, with two exterior pits, subangular at the periphery, convex beneath, grooved within the umbilicus; aperture oblique, lunate, with a well-developed, arcuate parietal tooth; peristome white, thickened within, reflected; on the right margin an obtuse inflected tooth, at the base a submarginal lamelliform tooth, with transverse tubercle in the centre; the basal lamella continued within the aperture, where it forms a strong white tubercle. Greater diameter 15, lesser 13 mill.; height, 7 mill.

Fig. 204.



T. introferens.

Helix introferens, BLAND, Ann. N. Y. Lyc., VII. 117, Pl. IV. Figs. 3, 4 (1860). — W. G. BINNEY, L. & Fr.-W. Sh., I. 132 (1869).

Triodopsis introferens, TRYON, Am. Journ. Conch., III. 51 (1867).

Gaston County, North Carolina; Salem, North Carolina. Valley of the Holston, Tennessee; Fanning County, Georgia; Aiken, South Carolina; Georgetown, District of Columbia. A species of the Cumberland Subregion.

This shell is closely allied to *vultuosa* and also to *fallax*. It differs from the latter in the narrower umbilicus, which only shows the penultimate whorl; in the groove in the last whorl within the umbilical opening, the character of the basal tooth, and the internal tubercle, which does not prevail in *fallax* and its immediate allies *tridentata* and *Hopetonensis*. In *introferens* the upper tooth is less deeply seated and less inflected, and the basal one is broader and more elevated than in *vultuosa*, the parietal tooth is more arcuate, being indeed subangular, but is without the indication, noticeable in *vultuosa*, of a callus extending from its lower termination towards the upper angle of the peristome. *T* *vultuosa* is even smaller than the var. *minor* of this species, which is only 11 mill. in diameter.

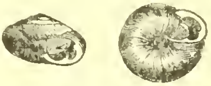
Jaw as usual in the genus; over 14 ribs.

Lingual membrane (Pl. XVI. Fig. C).

Triodopsis Hopetonensis, SHUTTLEWORTH.

Shell with a narrow, scarcely pervious umbilicus, depressed-globose, with numerous rib-like striæ, olive horn-color; spire obtuse, convex; whorls 5½, rather convex, the last scarcely deflected in front, constricted at the aperture; aperture lunar, tridentate; a moderate, tongue-shaped, slightly entering parietal denticle; peristome reflected, within thickened with a white, light callus, its right margin with a small, somewhat anterior denticle, its basal terminus with a marginal denticle. Greater diameter 13, lesser 11 mill.; height, 6 mill.

Fig. 205.



T. Hopetonensis.

Helix Hopetonensis, SHUTTLEWORTH, Bern. Mitt., 1852, 198. — REEVE, Con. Icon., No. 709 (1852). — PFEIFFER, Mon. Hel. Viv., III. 263; in CHEMNITZ, ed. II. 420, Pl. CXLVIII. Figs. 17, 18 (Pl. LXIV. Figs. 7-9 ?). — GOULD, Terr. Moll., III. 17. — W. G. BINNEY, Terr. Moll., IV. 72, Pl. LXXVII. Fig. 16; L. & Fr.-W. Sh., I. 132, Fig. 224 (1869).

Helix tridentata, var., BINNEY in Bost. Journ. Nat. Hist., III. 382, Pl. XVIII. Fig. 2. — FÉRUSSAC, Hist., Pl. LI. Fig. 3, small figure on the left.

Helix tridentata, var., *ephabus*, SAY, of RAVENEL'S Cat., 9 (1834), no descr.

Triodopsis Hopetonensis, TRYON, Am. Journ. Conch., III 52 (1867)

A species of the Florida Subregion, ranging as far north as Charleston, South Carolina, as far south as Fort George, St. John's River.

It differs from *T. fallax* in its smaller, scarcely pervious umbilicus, its deeper color, lighter peristome, and denticles being more widely separated.

Jaw as usual in the genus; over 10 ribs.

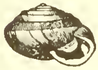
The lingual membrane (Pl. VII. Fig. N) has 27—1—27 teeth, as far as I can judge from an imperfect membrane. There are 7 laterals, the eighth tooth having its inner cutting point bifid.

Genitalia (Pl. XV. Fig. A) readily distinguished from those of *fallax*, *tridentata*, and others of the group by the length and cylindrical form of the genital bladder, and by the size of the duct of the same, which for a small portion of its course is considerably smaller than the bladder, and then suddenly enlarges and gradually expands until it reaches the vagina; in this particular the species is more like *tridentata* than *fallax*.

Triodopsis Van Nostrandi, Bland.

This species is in form and character of the aperture very nearly allied to *introferens*, but is more decidedly costate, more convex at the base, with smaller umbilicus, and without the internal tubercle. It connects *introferens* and *vultuosa* with, but is quite distinct from, *fallax*.

Fig. 206.



T. Van Nostrandi, enlarged.

The measurements of a specimen with 6½ whorls are: greater diameter 12½, lesser 11 mill.; height, 7 mill. Of a specimen with 6 whorls, greater diameter 10, lesser 8 mill.; height, 5 mill. (Bland.)

Helix Van Nostrandi, Bland, Ann. of Lyc. of Nat. Hist. of N. Y., XI. 200 (1875).

Probably a species of the Cumberland Subregion, though thus far only noticed at Aiken, South Carolina, and Augusta, Georgia.

Animal long, tail pointed; dirty white, darker on head, eye-peduncles, and tentacles.

Jaw as usual in *Triodopsis;* ribs 17.

Lingual membrane (Pl. VII. Fig. I) long and narrow. Teeth 24—1—24, with 10 laterals The centrals have no distinct side cusps or cutting points, but the latter are replaced by decided bulgings on the median cutting point. The figure gives the central, with the first, tenth, eleventh, nineteenth, and twenty-fourth teeth; the last two are marginals.

Genitalia (Pl. XV. Fig. G) differing from those of *tridentata*, *fallax*, and *Hopetonensis* by the swollen, elongated, oval genital bladder, and by its duct equally swollen, excepting at the base of the bladder, where it is narrow. The bladder with its duct appears like one long, swollen organ, with a median construction. Six individuals have these characters constant, but the difference is slight as a specific character.

Triodopsis vultuosa, Gould.

Vol. III. Pl. XL. a, Fig. 4.

Shell umbilicated, orbicular, depressed, about equally convex on both sides, rather solid, dark horn-color, delicately striated; spire a low dome, composed of about 5½ whorls, which are moderately convex, and separated by a well-defined suture, the exterior one somewhat angular at periphery; beneath, well rounded, and perforated by a deep umbilicus, about one fourth as broad as the base; aperture rather large, lunate; peristome moderately reflexed, tortuous, white, having at the base a small tooth, and at the centre a deeply seated, more expanded, reflexed tooth; the parietal wall bears a stout, elevated, arcuated, oblique lamella, joined to the lower extremity of the peristome only; on the base of the shell is a transverse internal tubercle. Greater diameter 10, lesser 9 mill.; height, 5½ mill.

Helix vultuosa, Gould, Pr. Bost. Soc. Nat. Hist., III. 39 (1848); in Terr. Moll., II. 189, Pl. XL. a, Fig. 4. — Reeve, Con. Icon., No. 711 (1852). — Pfeiffer, Mon. Hel. Viv., III. 263; in Chemnitz, ed. 2, III. 305, Pl. CXXVII. Figs. 10 - 12. — W. G. Binney, Terr. Moll., IV. 75; L. & Fr.-W. Sh., I. 133 (1869). — Bland, Ann. N. Y. Lyc., VII. 439, Pl. IV. Fig. 21.

Triodopsis vultuosa, Tryon, Am. Journ. Conch., III. 53 (1867).

Arkansas and Texas; a species of the Texas Subregion.

Jaw with 12 ribs.

Lingual membrane as in the genus: 20—1—20 teeth, with 11 laterals.

The form of this species described and figured by Bland (l. c.) has recently been called *Triodopsis Henriettæ* by Mazyck, Proc. Phila. Acad. Nat. Sci., 1877, 297. I hardly consider it distinct.

Triodopsis loricata, Gould.

Vol. III. Pl. XXIX. a, Fig. 1.

Shell umbilicated, depressed, spire less convex than the base, thin, of a yellowish-green color, having the surface everywhere ornamented with small, crescent-formed scales of the epidermis, in relief, arranged along the lines of growth, and in quincunx; whorls 5½, slightly convex, separated by a deeply impressed suture, and forming a low, conical spire; the periphery of the last whorl is slightly angular near its posterior portion; the base is rounded, tending rapidly to a deep, umbilical depression, with a small perforation; aperture small, very oblique, crescentic, having a small, acute tooth on the right margin of the peristome, a transversely oblong one at basal margin, and a prominent, compressed, curved, nearly horizontal one on the parietal wall, thus giving a three-lobed outline to the aperture; peristome white, slightly reflected, having a very profound constriction of the whorl directly behind it; on the base of the shell is an internal, transverse tubercle. Greater diameter, 6 mill.; height, 3⅓ mill.

Helix loricata, Gould, Proc. Bost. Soc. Nat. Hist., II. 165 (1846); Moll. Expl. Exped., 68, Fig. 39, a, b, c.; T. M. U. S., II. 145, Pl. XXIX. a, Fig. 1. — Pfeiffer, Mon. Hel. Viv., I. 416. — W. G. Binney, Terr. Moll., IV. 11; L. & Fr.-W. Sh., I. 134 (1869).

Helix Lecontii, Lea, Trans. Am. Phil. Soc., X. 303, Pl. XXX. Fig. 13; Obs., V. 59 (1853). — Pfeiffer, formerly, Mon. Hel. Viv., III. 265.

Triodopsis loricata, Tryon, Am. Journ. Conch., III. 54 (1867).

California, near San Francisco and Eldorado County, to Klamath County. A species of the California Region.

Its general form and its aperture are very much like *T. inflecta*, Say, though it is a much smaller shell, and the teeth of the aperture are less developed.

Its peculiar surface, resembling a scaly coat of mail, when closely examined, is highly characteristic.

Jaw long, broad, slightly arched, ends blunt, but little attenuated; with 11 broad, stout, crowded ribs, visible on both anterior and posterior surface, and crenulating either margin.

T. loricata (Pl. VII Fig. J) has over 20—1—20 teeth on its lingual membrane; 3 perfect laterals.

Genitalia not observed.

MESODON, Raf.

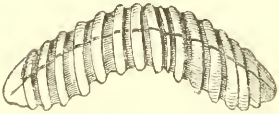
Animal as in *Patula* (q. v.); mantle subcentral.

Shell umbilicated, or with the umbilicus closed, subglobose or orbicularly depressed, thin, delicately striate, sometimes decussatedly sculptured; whorls 5–6, regular; aperture rotundly lunar, sometimes narrowed by a small denticle on the parietal wall; peristome thickened with white, expansively reflexed, its basal margin sometimes unidentate.

A genus strictly North American, widely distributed over the Eastern Province, scarcely represented in the Central or Pacific Provinces. It has come down from Post-pleiocene days.

Jaw stout, high, arcuate, wide, ends but little attenuated, blunt; no median projection to the cutting margin; anterior surface with numerous, separated, decided ribs, denticulating either margin. I have counted 13 in *M. major;* 10 in *albolabris;* 10 in *multilineata;* 11 in *Pennsylvanica;* 12 in *Mitchelliana;* 12 in *elevata;* 13 in *Clarki;* 13 in *exoleta;* 18 in *Wetherbyi;* 14 in *dentifera;* 7 in *Roëmeri;* 13 in *thyroides;* 10 in *clausa;* 8 in *Columbiana;*[1] 7 in *devia;* 10 in *profunda;* 15 in *Sayii;* 10 in *Mobiliana;* over 10 in *Downieana;* 10 in *Christyi* and *divesta*.

Fig. 207.



Jaw of *M. Sayii* (Morse).

I have had no opportunity of examining *M. Wheatleyi*, and *jejuna*.

Nothing has been published regarding the jaw and lingual dentition of the subgenus from species foreign to North America, as it is exclusively confined to this country.

The jaw of *Mesodon* does not essentially differ from that of *Triodopsis* and *Polygyra*, but may readily be distinguished from that of the other American subgenera.

The lingual membrane is long and narrow. The general arrangement of the teeth is as in *Patula*. The characters of the individual teeth are shown on my plate VIII. It will be seen that there are two distinct types of dentition among the species of the subgenus. The first form of dentition is found in *albolabris*, *Roëmeri*, *Wetherbyi*, *Downieana*, *Sayii*, *exoleta*, *Pennsylvanica*, *Mitchelliana*, *elevata*, *Columbiana*, *Mobiliana*, *devia*, *profunda*, *multilineata*, *dentifera*, *Christyi*,

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[1] See Ann. N. Y. Lyc. of N. H., X. Pl. XIV. Fig. 2.

divesta, *Clarki*. Even among these species there are some important variations. Thus I have failed to detect any side cutting points on the subobsolete side cusps of the central and first lateral teeth of *Roëmeri*, *Wetherbyi*, *Downieana*, *Sayii*, *exoleta*, *Pennsylvanica*, and *Mitchelliana*. All these species have their side cusp less developed than in the other species mentioned above. The presence of the cutting point may be detected by better manipulation than I am able to give, but as far as my powers go, I cannot find it. The large median cutting point, however, has a decided lateral bulging, which is readily mistaken for a distinct side cutting point, and indeed replaces it.[1] The outer laterals, however, in most of the species have a much more developed side cusp than the inner laterals, bearing a well-developed cutting point (Fig. A, Fig. 16), but not all the species, as some have no well-developed side cusp and cutting point on their outer laterals, nor does it appear except on the decided marginals. It is thus in *M. Sayii.*

I find also variation in the manner of passing from the lateral to the marginal teeth among the species of this first group of *Mesodon*. In *M. exoleta* the cutting point remains the same, and also in *Sayii*, *profunda*, *Wetherbyi*, and *Mitchelliana*, but in *elevata* the transition teeth are characterized by the bifurcation of the large cutting point; the same occurs in *albolabris*, *multilineata*, *Roëmeri*, *Columbiana*, and *devia*, and the rest of the group.

The general character of the teeth in this section of *Mesodon* is about the same as I have described above for *Triodopsis*. It will be noticed, however, that the marginals (as in *M. exoleta* and *Wetherbyi*) do not always have their cutting points bifid.

The other type of dentition in the subgenus *Mesodon* is shared by *M. thyroides*, *clausa*, and *Wheatleyi*. The centrals and first laterals have subobsolete side cusps without cutting points, the outer laterals have no side cusp, but retain the type of the first laterals, they are much longer, narrower, and have one extremely long, oblique, stout, bluntly pointed cutting point, reaching far beyond the lower margin of the base of attachment. These outer laterals pass gradually into the marginals, which retain their general form, but have a less developed reflection, and much more proportionally developed cutting point, sometimes bifid in the extreme marginals, and usually with a small side cutting point.

As in all the genera of disintegrated *Helix*, the marginal teeth of *Mesodon* show great variation in their denticulation, even in most cases on the same membrane.

The study of the dentition of *Mesodon* shows that we must be prepared to find considerable variation in the character of the teeth of any genus. The peculiar outer lateral teeth and marginals of *M. thyroides*, for instance, would hardly have been expected, so utterly different are they from those of *albolabris*. Again, we should hardly have expected to find such a difference in the same genus as the presence and absence of side cutting points on the central and first lateral teeth.

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[1] I regret my inability to review the membranes of all our species to ascertain the relations of this bulging to the side cutting point. Those who in future study the subject must pay especial attention to this point. The figures of Semper (Phil. Archip.) are the most satisfactory ever published.

Mesodon major, BINNEY.

Vol. III. Pl. I.

Shell imperforate, conoidly subglobose, solid, with crowded, fold-like striæ, and a few interstitial microscopic revolving lines; reddish horn-color or chestnut; spire conoid, the apical point small; whorls 6, convex, the last ventricose, scarcely descending in front; aperture diagonal, roundly lunate, whitish within; peristome with a white thickening, its terminations joined by a thin callus, the right and basal portions rather broadly expanding and reflected, the columellar portion subdentate, dilated, subexcavated, adhering. Greater diameter 37½, lesser 31 mill.; height, 26 mill.

Helix major, BINNEY, Bost. Journ. Nat. Hist., I. 473, Pl. XII. (1837); Terr. Moll., II. 96, Pl. I. — DEKAY, N. Y. Moll., 45 (1843). — MRS. GRAY, Fig. of Moll. An., Pl. CCXCI. Fig. 1, from Bost. Journ., no descr. — W. G. BINNEY, Terr. Moll., IV. 43; L. & Fr.-W. Sh., I. 135 (1869). — PFEIFFER, Mon. Hel. Viv., IV. 320.

Helix albolabris, var., FÉRUSSAC, Hist., Pl. XLIII. Fig. 4; Pl. XLVI. a, Fig. 7. — DESHAYES in FÉR., part. — PFEIFFER, Symbolæ, II. 22; Mon. Hel. Viv., I. 290; in CHEMNITZ, ed. 2, I. 81. — REEVE, Con. Icon., 656. — BLAND, N. Y. Lyc., VI. 359.

Mesodon major, TRYON, Amer. Journ. Conch., III. 43 (1867).

This form seems to inhabit a narrow strip of territory east of the mountains from Abbeville, South Carolina, to the Gulf of Mexico. At Aiken, South Carolina, it is well marked, more so at Macon, Columbus, and Butler, Georgia. Dr. Binney found it in West Florida. It is common in the City Cemetery of Macon, Georgia.

It is much more globose than *albolabris*, of a coarser and more solid texture, and the striæ of increase are much more raised and prominent, so much so, indeed, as to leave distinct grooves between them. The revolving striæ, so distinct on that shell, are either wanting or very indistinct. The aperture is smaller in proportion to the size of the shell, less flattened towards the plane of the base, and more rounded. The parietal wall and umbilicus are in many instances covered with a smooth and shining, semi-transparent, testaceous callus, and in one specimen in my cabinet bears a well-developed tooth. The margin of the peristome is thickened, the peristome itself is narrower, less abruptly reflected, and not so much flattened, and there is often a tooth-like process on the inner and upper side of the margin near the umbilicus. The color of the epidermis is generally much darker. The only considerable variation in the characters of the shell is caused by the depression of the spire in some individuals, and indeed in all specimens from certain localities. In its most perfect condition it is often subconical. It is subject to some irregularities in the form of the aperture, and there is sometimes an indication of pale bands in the epidermis of the body-whorl.

A large individual had the greater diameter 48, lesser 40 mill.; height, 30 mill.

Animal: head, upper part of neck, tentacles, and eye-peduncles, ferruginous; eyes black; foot rusty, the sides more or less shaded with blue by the fluids of the animal, which are visible through its semi-transparent substance. Eye-peduncles short, in proportion to the size of the animal, and robust, their situation, when retracted, marked by brown lines. Foot large and thick. Genital orifice indicated by a slight prominence. Superficial glands large and distinct. On the centre of the back is a line of them, of an oblong narrow shape, with a furrow on each side; those on the sides and posterior part of the foot, when examined by a microscope, exhibit numerous subcutaneous white dots, or points, arranged in clusters. Length equalling twice the diameter of the shell (see Bost. Journ. N. H., I. Pl. 1).

Jaw and lingual membrane as in *albolabris*. Pl. VIII. Fig. G, shows the latter.

Genitalia also same as in *albolabris* (see Proc. Phila. Ac. Nat. Soc., 1876, 189, Pl. VI. Fig. 1).

I still retain as a distinct species the form known as *major*, though the study of the limits of variation in the shells of our species has led me strongly to doubt its specific value. I am inclined to consider it as a greatly developed form of *albolabris*, caused by certain peculiarly favorable local causes in a certain portion of the Southern Region.

Mesodon albolabris, Say.

Vol. III. Pl. II.

Shell imperforate, convex; epidermis immaculate, of a uniform yellowish-brown, russet, or light chestnut-color; whorls 5 – 6, with fine parallel striæ running obliquely across them, and spirally striated with very minute and delicate, but distinct, wavy, impressed lines, which are most apparent on the back of the reflected peristome; suture well marked and distinct; aperture contracted by the peristome; peristome white, flattened in the plane of the mouth, abruptly and very widely reflected; umbilicus of the mature shell covered by the reflected peristome, which is continued to the base of the shell. Greater diameter 30, lesser 26 mill.; height, 17 mill.

Helix albolabris, Say, Nich. Encycl., Pl. I. Fig. 1 (1817 – 1819); Journ. Acad. Nat. Sci. Phila., II. 161 (1821); American Conch., No. 2, Pl. XIII. (1831); Binney's ed., 21, Pl. LXIX. Fig. 1. — Chenu, Bibl. Conch., III. 21, Pl. III. Fig. 3, a. — Adams in Thompson's Vermont, I. 158, with wood-cut. — Eaton, Zoöl. Text-Book, 193 (1826). — Férussac, Tab. Syst., 36; Hist., Pl.

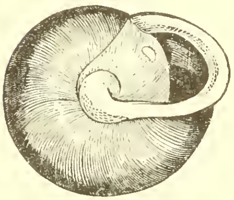
XLIII. Figs. 1, 2, 3. — BINNEY, Bost. Journ. Nat. Hist., I. 475, Pl. XIII. (1837); Terr. Moll., II. 99, Pl. II. — DEKAY, N. Y. Moll., 26, Pl. II. Fig. 12 (1843). — GOULD, Invert., 170, Fig. 101 (1841); ed. 2, 423 (1870). — LEIDY, T. M., I. 252. Pl. VI. (1851), anat. — PFEIFFER, Symb., II. 22, excl. γ and δ; Mon. Hel. Viv., I. 290, excl. β and γ; in CHEMNITZ, ed. 2, I. 81, Pl. XV. Figs. 7, 8 (1847), excl. var. C and D, Pl. X. Figs. 4, 5. — POTIEZ et MICHAUD, Gal. I. 69. — REEVE, Con. Icon., No. 624. — DESHAYES in FÉR., I. 137, Pl. XLIII. Figs. 1, 2, 3, 5. — BILLINGS, Canadian Nat. and Geol., 1857, II. 98, Figs. 2, 3. — BLAND, Ann. N. Y. Lyc., VI. 358 (1858). — W. G. BINNEY, Terr. Moll., IV. 43; L. & Fr.-W. Sh., I. 136, Figs. 229, 230 (1869). — MORSE, Amer. Nat., I. 6, Pl. I. Figs. 1-11; 96, Fig. 2 (1867).

Helix rufa, DEKAY? N. Y. Moll., 44, Pl. III. Fig. 30 (1843).

Mesodon albolabris, MORSE, Journ. Portl. Soc., I. 8, Fig. 7, Pl. III. Fig. 8 (1864). — TRYON, Am. Journ. Conch., III. 39, 44 (1867).

A species of the Eastern Province. Canada to Arkansas, Georgia to Minnesota. Also in the Post-pleiocene of the Mississippi Valley.

Fig. 208.



M. albolabris, var.

Specimens of *M. albolabris* are sometimes found bearing a well-developed parietal tooth. Such are very plenty in the Alleghany Mountains in Pennsylvania. One is here figured (Fig. 208).

The genitalia and lingual dentition of this form is the same as in the typical form.

Pfeiffer's var. γ and δ of the Symbolæ are respectively *major* and *exoleta*. In the Monograph his β is perhaps the former, and his γ certainly is. In Chemnitz ed. nov. he figures *exoleta* as var. D, and places *major* as C. In Vol. VII. of the Monographia the synonymy of the group is correctly given.

Deshayes in Férussac's History erroneously gives Guadeloupe as the habitat. From his reference to Férussac's plates he seems to confound *major* with *albolabris*.

Petiver mentions this species in Phil. Trans., 1698, p. 395.

I have this species from fourteen States. The series presents very remarkable variation in the height of the spire and in the form of the aperture. From Illinois I have a few of a large variety (greater diameter. 35 mill.), furnished with a strong, tooth-like prominence on the peristome, near its columella extremity. There is a variety, quite common among the Pennsylvania Mountains, characterized by a strong parietal denticle. It might readily be confounded with *exoleta*, but wants the more ventricose body whorl of the latter, and differs widely in its genitalia.

It occurs fossil in the Post-pleiocene. From Natchez Bluff I have specimens with a remarkably flattened spire.

A reversed individual has been noticed.

Animal varying from pure white and cream-color, through various shades of gray to blackish; upper part of head and neck slightly brownish: extremities of eye-peduncles smoky; eyes black. Eye-peduncles more than 12 mill. in length when fully extended, slender and cylindrical. Foot with a slightly expanded margin terminating posteriorly in an acute angle. Glandular tubercles very distinct and prominent, on the back arranged longitudinally, on the eye-peduncles long and narrow. Extreme length, 62 mill. (See Vol. III. Pl. II.)

The animal deposits about fifty eggs at each laying, which is repeated one or more times during the season. The eggs are three sixteenths of an inch in their greatest diameter, and covered with minute points. The last laying is often delayed to so late a period of the year that the earth is covered with snow before they are hatched. The development of the embryo is then suspended until the next spring. When newly excluded from the egg the shell consists of one whorl and a half, the length of its column or axis being about one eighth of an inch, and its breadth somewhat less. No umbilicus is then discernible. I have not been able to determine how much time is required to complete its growth, but I am induced to believe that the peristome, the evidence of maturity, is added in the second year.

The jaw is arcuate, of uniform breadth throughout; ends blunt, smooth on their anterior surface, the balance of the jaw with 10 stout ribs, denticulating either margin.

Outer laterals of the lingual membrane have distinct side cusps as well as cutting points. Teeth 44—1—44, with about 12 laterals. (Pl. VIII. Fig. K.)

Genitalia, as well as complete anatomy, figured by Leidy, l. c. The penis sac is stout, rather short, cylindrical, with a median prepuce (*b*); it receives the vas deferens at its summit; the retractor muscle is inserted on the vas deferens near its junction with the penis sac; the genital bladder is long, stout, blunt at its summit, its duct is very narrow at its entrance into the bladder for a short portion of its course, then becomes suddenly expanded into very much the shape and still greater size of the bladder. This peculiar arrangement of the genital bladder and its duct forms a good specific character, distinguishing *albolabris* from *exoleta* and other species. I have found its characters constant in the numerous individuals I have examined. As it is wanting in the figure given by Semper (Phil. Archip., Pl. XIV. Fig. 16), I am inclined to doubt the identity of his specimen. Lehmann (Mal. Blatt., XI. Pl. I. Fig. 1, 1864) no doubt drew his figure from a true *albolabris*.

The figure of the jaw given by Leidy represents it imbedded in the tissues of the head above.

Mesodon divesta, Gould.

Vol. III. Pl. XIII. a, Fig. 2.

Shell imperforate, depressed, somewhat discoidal, of medium thickness and a dingy horn-color, sculptured with coarse oblique furrows; spire slightly convex, whorls about 6, a little convex, and separated by a well-impressed suture;

the outer whorl is a little angular at its periphery; beneath, it is more smooth, moderately convex, with the central region excavated, and covered with a glazing of white callus; the aperture is lunate, and very oblique; the peristome is white, broadly reflected, its basal portion horizontal, and its outer portion flexuous. Greater diameter 20, lesser 15 mill.; height, 8 mill.

Helix dejecta, GOULD, Terr. Moll., II. 91. Not preocc. in *mesodon*.
Helix abjecta, GOULD, Proc. Bost. Soc. Nat. Hist., III. 40 (Oct., 1848); Terr. Moll., II. 122, Pl. XIII. a, Fig. 2. — PFEIFFER, Mon. Hel. Viv., III. 270.
Helix divesta, GOULD, Terr. Moll., II. 357. — W. G. BINNEY, Terr. Moll., IV. 51; L. & Fr.-W. Sh., I. 138 (1869). — PFEIFFER, Mon. Hel. Viv., IV. 322.
Mesodon divesta, TRYON, Am. Journ. Conch., III. 45 (1867).

Washita Springs, Arkansas; Vernon County, Mississippi. It may prove to be a species of the Texan Subregion.

Jaw with 10 ribs.

Lingual membrane (Pl. XVI. Fig. V) as in *albolabris:* teeth 46—1—46, with 16 laterals.

The genitalia are as usual in the genus: the penis sac is very long, cylindrical, stout, tapering at the top; the vas deferens enters at its apex; the retractor muscle is attached to the vas deferens; the genital bladder is short, oval, stout, on a short, stout duct.

Mesodon multilineata, SAY.

Vol. III. Pl. III.

Shell imperforate, depressed-subglobose; spire convex, rather thin; epidermis yellowish brown, or russet-color, with numerous reddish-brown, finely undulated, revolving lines and bands; whorls between 5 and 6, convex, with delicate, parallel, oblique striæ, the last ventricose; suture distinctly marked; aperture lunate, slightly contracted by the peristome; peristome white, not much expanded, reflected, rather thin; umbilical region impressed. Greater diameter 23, lesser 20 mill.; height, 14 mill.

Helix multilineata, SAY, Journ. Acad. Phila., II. 150 (1821); ed. BINNEY, 15. — FÉRUSSAC, Hist., Pl. XLVI. a, Fig. 3. — BINNEY, Bost. Journ. Nat. Hist., I. 480, Pl. XIV. (1837). — Terr. Moll., II. 103, Pl. III. — LEIDY, Terr. Moll. U. S., I. 254, Pl. VIII. Figs. 1-6 (1851), anat. — DEKAY, N. Y. Moll., 41, Pl. III. Fig. 34 (1843). — PFEIFFER, Symb. ad Hist. Hel., I. 41; Mon. Hel. Viv., I. 290; in CHEMNITZ, ed. 2, II. 41, Pl. LXXI. Figs. 17-19 (1849). — REEVE, Con. Icon., No. 691 (1852). — DESHAYES in FÉR., I. 113. — W. G. BINNEY, Terr. Moll., IV.
Mesodon multilineata, TRYON, Am. Journ. Conch., III. 45 (1867).

In the States bordering on the Ohio River, from New York to Minnesota. It is a species of the Interior Region.

Animal blackish, granulated; granules whitish with darker interstices; foot, beneath, black.

The specimens figured show how variable the species is in size. In color it is also very variable; sometimes it is found of a uniform red, at others albino.

The varieties mentioned by Pfeiffer and Deshayes are distinguished merely by the revolving bands. In a large suite of specimens it is rare to find two on which these bands and lines are similarly arranged. Some have a parietal tooth.

It would appear from the statement made by Dr. Kirtland that its habits are somewhat peculiar. "Wet marshes are its principal resort, where, during summer, it may be seen climbing about on weeds and blades of grass, apparently endeavoring to avoid the water collected beneath it. At the approach of winter it retreats to the tops of the carex-bogs, where several dozen may be found collected together in a torpid state, with the mouths of their shells closed with an epiphragm. They usually form a shallow excavation on the bog, concealed beneath the tufts of dead grass." The numbers collected in these retreats are sometimes "agglutinated into one mass." This habit of attaching themselves to each other in numbers, during their hibernation, I have not witnessed in any other of our species, but I believe it is common in some European species.

Jaw arcuate, of uniform width; ends blunt; anterior surface with numerous, crowded ribs, denticulating either margin.

Lingual membrane (Pl. VIII. Fig. L) with 42—1—42 teeth; 17 perfect laterals.

Genitalia (see Vol. I., l. c.). Penis sac long, stout, with a very highly developed prepuce on the greater part of its course, then tapering to its summit, where it receives the vas deferens and retractor muscle; genital bladder long, subcylindrical, its duct but slightly smaller, short, swollen at its entrance into the vagina; oviduct greatly convoluted.

Mesodon Pennsylvanica, GREEN.

Vol. III. Pl. VII.

Shell imperforate, convex, elevated; epidermis yellowish horn-color, or russet; whorls 6, convex, with crowded, elevated, oblique striæ; suture distinctly marked; aperture subtriangular, contracted by the peristome; peristome white, narrow, reflected, not flattened, with sometimes a slight thickening on the inner side near the base; umbilical region indented. Greater diameter 17, lesser 15 mill.; height, 11 mill.

Helix Pennsylvanica, GREEN, Contributions to Macl. Lyc., Nos. 1, 8. — BINNEY, Bost. Journ. Nat. Hist., I. 483, Pl. XVI. (1837); Terr. Moll., II. 105, Pl. VII. — PFEIFFER, Symbolæ, II. 36; Mon. Hel. Viv., I. 291 (excl. *H. clausa*); IV. 321; in CHEMNITZ, ed. 2, II. 51, t. LXXIII. Figs. 4, 5 (excl. *H. clausa*). — DEKAY, N. Y. Moll., 41, Pl. III. Fig. 35 (1843). — MRS. GRAY, Fig. Moll. An., Pl. CCXCI. Fig. 5, from Bost. Journ., no descr. — REEVE, Con. Icon., No. 676 (excl. syn.). — BLAND, Ann. N. Y. Lyc., VI. 299 (1858). — W. G. BINNEY, Terr. Moll., IV. 45; L. & Fr.-W. Sh., I. 140 (1869).

Helix Mitchelliana, DESHAYES in FÉR., I. 137, Pl. XCVII. Figs. 4–7, not 13–16.

Mesodon Pennsylvanica, TRYON, Am. Journ. Conch., III. 44 (1867).

Western part of Pennsylvania, Ohio, Illinois, Kentucky, Munroe County, Virginia. It thus appears a species of the Interior Region.

Animal: upper surface of a dull, uniform lead-color, lower surface of the foot lighter; about twice as long as the transverse diameter of the shell (see B. J. N. H, I. Pl. V).

This species may be readily distinguished from *clausa* and *Mitchelliana* by its somewhat triangular aperture, which is more like that of *elevata;* it is more elevated, has usually 6 whorls, more convex, and with deeper suture than in *clausa*. In mature shells the inner margin of the peristome, near the columella, has a tooth-like callus, very similar to that often prevailing in forms of *exoleta, thyroides,* and *albolabris*. The umbilicus is invariably more or less open in *clausa*, but closed in *Pennsylvanica* and *Mitchelliana*.

Green described this species in 1827, and deposited three specimens of it in the collection of the Philadelphia Academy, where they are still preserved. In 1837 another description and an excellent figure were published by Binney in a well-known and widely circulating Journal. It is, therefore, surprising that so many authors and collectors have confounded it with *M. clausa*, quite a distinct species. Such, however, has been the case, as a reference to the above synonymy will show. It is, however, well known under its correct name by means of the figures published by Binney, Reeve, and Chemnitz, ed. 2. Deshayes is the only one who has figured it under a wrong name.

Bland has carefully and correctly arranged the synonymy in his valuable "Notes," l. c.

Pfeiffer adds doubtfully to the synonymy *H. thyroides* var. *edentula* of Beck, Ind. p. 23.

Jaw very arcuate, of uniform width; ends blunt; anterior surface with 11 stout, crowded ribs, denticulating either margin.

Lingual membrane (Pl. VIII. Fig. E) with 40—1—40 teeth; 13 perfect laterals. Morse counted 120 rows of 39—1—39 teeth. The outer laterals have the side cusp decidedly developed.

The upper portions of the genital system (Pl. XV. Fig. G) not observed. The penis sac is long and slender, with the vas deferens and retractor muscle entering its apex, and its orifice entering the vagina near its base. The genital bladder is long, stout, cylindrical, with a median contraction; its duct is hardly distinct from it, with an entrance opposite that of the penis sac. The prostate is very large.

The animal of this, and many other species, is often overrun with great numbers of Acari, resembling *Acarus limacum* of Europe. There appears to be at least two species of them. They are very minute, flesh-colored, and move with great rapidity, often entering and coming out of the respiratory foramen. Their presence does not seem to cause any uneasiness, nor even to be felt by the snail.[1]

Mesodon Mitchelliana, Lea.

Vol. III. Pl. IV. outline figs.

Shell imperforate, depressed conoid-globose, thin, with crowded striæ and very crowded decussating microscopic lines, pellucid, horn-color, polished; spire briefly conoid; whorls 5, moderately convex, gradually increasing, the last ventricose, subconstricted and briefly deflected anteriorly; aperture diagonal, lunate, sub-pearleaceous within; peristome white, thickened, its terminations slightly converging, subequally reflected, that of the columella narrow, adherent, or subdilated and spreading. Greater diameter 16½, lesser 14½ mill.; height, 10 mill.

Helix Mitchelliana, Lea, Am. Phil. Trans., VI. 87, Pl. XXIII. Fig. 71; Obs., II. 87 (1839); Troschel, Arch. f. Nat., 1839, II. 221. — DeKay, N. Y. Moll., 45 (1843). — Pfeiffer, Mon. Hel. Viv., I. 291; IV. 322. — Bland, Ann. N. Y. Lyc., VI. 339 (1858). — W. G. Binney, Terr. Moll., IV. 47; L. & Fr.-W. Sh., I. 141 (1869).

Helix clausa, Binney, Terr. Moll., II. 109; in Vol. III. Pl. IV., outline figures.

Mesodon Mitchelliana, Tryon, Am. Journ. Conch., III. 45 (1867).

Kentucky and Ohio, along the Ohio River; Munroe County, Virginia; Cherokee County, North Carolina. A species of the Interior Region.

In *M. clausa* the umbilical region is more widely excavated, and the groove behind the reflected peristome producing the contraction of the aperture, is continued at the base of the shell, becoming wider as it joins the umbilical opening. In *M. Mitchelliana* the groove is almost obliterated at the point of reflection of the peristome over the umbilicus, by the more tumid character of the last whorl.

Jaw arcuate, of uniform width throughout; ends blunt; anterior surface with 12 crowded, coarse ribs, denticulating either margin.

Lingual membrane (Pl. VIII. Fig. H) with 49—1—49 teeth; 18 laterals. Outer laterals have side cusps and cutting points.

The genital system is long and narrow. The oviduct is greatly convoluted. The penis sac is long, stout, cylindrical, with a bulb-like expansion at its apex, at which point both vas deferens and retractor muscle are inserted. The genital bladder is lengthened, ovate, not much larger than its duct, which is short, and enters the vagina below the middle of its length (Pl. XI. Fig. H).

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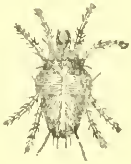
[1] *Hypopus concolor,* Haldeman. Oval, nearly colorless or very pale ochraceous; bristled; sides impressed. Length 0.4 millim.

Differs in outline from the European species, which it resembles in general appearance, mode of life, and in the large pair of projecting setæ anteriorly and posteriorly. A colored dorsal line has been observed.



Mesodon elevata, Say.

Vol. III. Pl. IX.

Shell imperforate, very convex, elevated, almost conical; epidermis yellowish horn-color; whorls nearly 7, rounded, with fine, oblique, transverse striæ, the last ventricose; suture distinct; aperture contracted by the peristome, somewhat triangular; peristome white, thickened, reflected, its basal portion with an obsolete, lamellar denticle; parietal wall with a large, white, robust, obliquely curved tooth; umbilicus covered. Greater diameter 25, lesser 20 mill.; height, 7 mill.

Helix elevata, Say, Journ. Acad. Phila., II. 154 (1821); American Conchology, No. 4, Pl. XXXVII. Fig. 2 (1832); Binney's ed. 27, Pl. XXXVII. Fig. 2; ed. Chenu, Bibl. Conch., III. 48, Pl. XIII. Fig. 2, *a*. — Binney, Bost. Journ. Nat. Hist., I. 490, Pl. XIX. (1837); Terr. Moll., II. 126, Pl. IV. — Leidy, T. M. U. S., I. 256, Pl. X. Figs. 4, 5 (1851), anat. — DeKay, N. Y. Moll., 36, Pl. III. Fig. 20 (1843). — Mrs. Gray, Fig. Moll. An., Pl. CXCI. Fig. 7, no descr. — Pfeiffer, Symb. Hist. Hel., II. 27; Mon. Hel. Viv., I. 317; in Chemnitz, ed. 2, I. 56, Pl. VII. Figs. 11, 12 (1846). — Reeve, Con. Icon., No. 681 (1852). — Deshayes in Fér., I. 329.

Helix Tennesseensis, Lea, Trans. Am. Phil. Soc., IX. 1; Obs., IV. 1 (1844); Proc., II. 31 (1841); Troschel's Arch. f. Nat., 1837, II. 124.

Helix Knoxvilliana, Férussac, Hist., Pl. XLIX. Figs. 5, 6.

Xolotrema elevata, Tryon, Am. Journ. Conch., III. 48 (1867).

A Post-pleiocene species, now found in the Interior Region from Georgia (on the banks of the Tennessee River) to Wisconsin; from New York to Missouri; not east of the Alleghanies.

Animal: ashy brown on the upper surface, lighter on the posterior extremity and sides; mantle grayish-white; glands prominent and distinct. (See Bost. Journ. Nat. Hist., I. Pl. VIII.)

There is a form furnished with a brownish, revolving band upon the body-whorl; found in Eastern Tennessee.

Jaw as usual in the genus; over 12 ribs.

Lingual membrane (Pl. VIII. Fig. M), with about 45—1—45 teeth, 17 laterals; the eighteenth tooth having its inner cutting point bifid.

Genitalia (see Vol. I., l. c.). Penis sac long, stout, cylindrical, receiving retractor muscle and vas deferens at its summit; genital bladder long, rounded, stout, gradually and obtusely attenuated above, with a short duct.

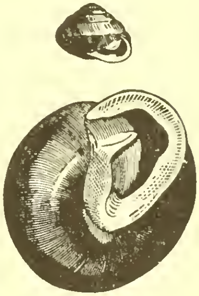
Mesodon Clarki, Lea.

Shell imperforate, globosely rounded, regularly and finely striated, reddish horn-color; spire obtusely conic; whorls 7, convex, with delicate incremental striæ, the last one very globose and rounded below; aperture lunate; peristome white, thickened, reflected, its basal termination quite heavy and covering the umbilicus entirely; one elongated, white denticle on the parietal wall of the aperture. Greater diameter 14, lesser 13 mill.; height, 9 mill.

Helix Clarkii, Lea, Proc. Acad. Nat. Sc. Philad., 1858, 41; Journ. —; Obs., XI. 138, Pl. XXIV. Fig. 111. — W. G. Binney, Terr. Moll., IV. 53, Pl. LXXVII. Fig. 10; L. & Fr.-W. Sh., I. 143 (1869).

Xolotrema Clarkii, Tryon, Am. Journ. Conch., III. 48 (1867).

Fig. 209.



M. Clarki.

Cherokee County, North Carolina; also in Georgia and Eastern Tennessee. It is a species of the Cumberland Subregion.

The lower figure was photographed on to the wood.

Jaw as usual, arcuate, ends attenuated, blunt; anterior surface with about 14 stout, separated ribs, denticulating either margin.

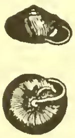
Lingual membrane long and narrow. Teeth about 35—1—35. Centrals with a stout, short, median cusp, bearing a very short, blunt cutting point, the outer cusps subobsolete. Laterals 15, like the centrals, but asymmetrical. Marginals wide, low, with one inner, short, broad, sharply bifurcated cutting point, and one shorter, outer, bifurcated cutting point; those figured are very bluntly denticulated; on other portions of the same membrane the cutting points are much more developed and more acute (Pl. VIII. Fig. I).

The genital system (Pl. XI. Fig. G) is peculiar in several respects. The ovary is very slender, and equals about one half the length of the oviduct. The epididymis is highly developed, greatly convoluted, stout, four times the length of the ovary. The oviduct is convoluted. The prostate is greatly developed. The penis sac is short, cylindrical, entering the vagina near its base, and receiving both vas deferens and retractor muscle at its apex. The genital bladder is small, oval, with a short duct entering the vagina about the middle of its length. The vas deferens is swollen on leaving the prostate. Testicle not observed.

Mesodon Christyi, Bland.

Shell imperforate, depressed, rather solid, with numerous oblique rib-like striæ, dark horn-colored; spire short, obtuse; whorls 4½, rather convex, the last descending at the aperture, slightly angular at the periphery, constricted, above gibbous; base convex, excavated in the middle; aperture depressed, with a strong, oblique, lamelliform parietal tooth; peristome reflected, with a white callus within. Greater diameter 10, lesser 8 mill.; height, 4½ mill.

Fig. 210.



M. Christyi.

Helix Christyi, Bland, Ann. N. Y. Lyc., VII. 117, Pl. IV. Figs. 5, 6 (1860). — W. G. Binney, L. & Fr.-W. Sh., I. 141 (1869).

Mesodon Christyi, Tryon, Am. Journ. Conch., III. 40 (1867).

Mountains in Cherokee County, North Carolina: a species of the Cumberland Subregion; also in Rutherford County, North Carolina.

Jaw as usual in the genus: 10 ribs.

Lingual membrane (Pl. XVI. Fig. E) with 40—1—40 teeth.

Mesodon exoleta, Binney.

Vol. III. Pl. X.

Shell imperforate, convex, somewhat ventricose; epidermis of a uniform yellowish-horn, or russet-color; whorls between 5 and 6, with fine, parallel striæ crossing them obliquely; body-whorl large and ventricose; suture well marked and distinct; aperture rounded, contracted by the peristome, the plane of the aperture making a considerable angle with the plane of the base; peristome thickened, white, reflected, its basal portion subdentate; parietal wall with a prominent, white, oblique tooth; umbilicus covered. Greater diameter 28, lesser 23 mill.; height, 17 mill.

Helix exoleta, Binney, Terr. Moll., II. 131, Pl. X. — Leidy, T. M. U. S., 256, Pl. X. Figs. 1-3, anat. — DeKay, N. Y. Moll., 27, Pl. II. Fig. 6. — W. G. Binney, Terr. Moll., IV. 54; L. & Fr. W. Sh., I. 144 (1869).

Helix zaleta, Binney, Bost. Journ. Nat. Hist., I. 492, Pl. XX. — Mrs. Gray, Fig. Moll. An., Pl. CXCI, Fig. 9, from Bost. Journ., no descr. — Pfeiffer, Mon. Hel. Viv., I. 316. — Deshayes in Fér., I. 139. — Reeve, Con. Icon., No. 692 (1852).

Helix albolabris, var., Férussac, Pl. XLVI. a, Fig. 6. — Pfeiffer, Symb., II. 22 (no descr.); in Chemnitz, ed. 2, I. 81, Pl. X. Figs. 19, 20.

Mesodon exoleta, Tryon, Am. Journ. Conch., III. 39 (1867).

A Post-pleiocene species, now found in the Interior Region. From Western New York and Pennsylvania to Missouri; from Georgia and Alabama to Illinois.

Animal grayish-brown or blackish above, paler on the posterior extremity and base; eye-peduncles black, long, and slender; glands very prominent; length, when fully extended, including the eye-peduncles, equal to thrice the breadth of the shell. (See Bost. Journ. Nat. Hist., I. Pl. IX.)

Though resembling *M. albolabris* in many respects, it differs in general aspects, and in many very observable particulars. It is smaller, more convex, and the body-whorl is more ventricose than in that species. The peristome is less flat and broad, and is sometimes a little grooved. The aperture is more round, and the plane of the mouth, instead of being flattened in the direction of the plane of the base, is much more upright, making a considerable angle with the base of the shell. Attention to these differences will enable one to distinguish the shell, even before the tooth is added. In those individuals where the tooth is wanting, there is often a slight deposition of testaceous matter in its place, not distinguishable without close observation. In its genitalia it has decided specific distinction (see p. 319).

The color of the animal varies in being more or less dark; but I have never seen an individual which approached the white, pearly, or cream-color, which is so common in the animal of *M. albolabris*. The eggs are white, one eighth of an inch in diameter, and are laid in the earth as deep as the body of the animal will extend, in clusters of about twenty.

There is certainly a strong resemblance between many of our species, which, with *M. albolabris* as their type, form a well-marked division. But as their differences are as constant as their resemblances, it cannot be proper to unite them into one.

When Dr. Binney published the first description of this shell, in 1837, he adopted, without examination, the name *zaleta*, which he found applied to it in some cabinets, and which he then supposed had been applied by Mr. Say. Finding no description of it, he subsequently applied the correct name *exoleta*, originally suggested, no doubt, by the idea that the species is an old or superannuated form of *albolabris*.

Jaw narrow, slightly arcuate, somewhat attenuated towards the ends; anterior surface with 13 ribs; both margins denticulated.

Lingual membrane (Pl. VIII. Fig. A) with 60—1—60 teeth; 11 perfect laterals, but even the eighth tooth shows a decided modification in form.

I have already referred to the peculiarity of this species in having sometimes and sometimes wanting side cutting points to the outer lateral teeth, and a bifurcation to the inner cutting point of the marginals (see Proc. Phila. Acad. Nat. Sci., 1875, 243). I here figure teeth from a lingual membrane differing in this respect from that figured by me before (l. c. Pl. XI. Fig. 7). The cutting points of the central and first lateral teeth have a lateral bulging which represents the side point. This point appears about the eleventh tooth.

Fig. *a* represents an inner marginal tooth from another membrane, agreeing with my former figure in having a simple, not bifid, inner cutting point.

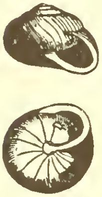
I am sure of the identity of each individual examined, having verified it by the peculiar genital bladder and penis sac.

Genitalia figured by Leidy, Vol. I., l. c. The penis sac is very stout, long, cylindrical, receiving the retractor muscle and vas deferens at its summit; genital bladder subconical, on a short, small duct; the vas deferens is convoluted as it leaves the prostate. As already stated, these organs are specifically different from those of *albolabris*, whose shell is so nearly allied to that of *exoleta*.

Mesodon Wheatleyi, BLAND.

Shell imperforate, depressed, conoid-globose, thin, reddish horn-colored, with numerous rib-like striæ, and microscopic granulations with very short hairs; spire shortly conoid; suture deeply impressed; whorls 5½, rather convex, the last rounded, slightly depressed at the aperture, constricted; base convex, excavated in the umbilical region; aperture oblique, lunate, with a small parietal tooth-like tubercle; peristome acute, rose-colored, equally angularly reflected, appressed at the columella. Greater diameter 14, lesser 12 mill.; height, 7 mill.

Fig. 211.



M. Wheatleyi.

Helix Wheatleyi, Bland, Ann. N. Y. Lyc., VII. 118, Pl. IV. Fig. 19 (1860). —W. G. Binney, L. & Fr.-W. Sh., I. 145 (1869).
Mesodon Wheatleyi, Tryon, Am. Journ. Conch., III. 40 (1867).

Mountains in Cherokee County and at Hayesville, North Carolina. It may prove a species of the Cumberland Subregion.

Jaw as usual in the genus, with about 12 ribs.

Lingual membrane long. Teeth about 67—1—67, with over 12 laterals. Centrals and laterals as usual in the genus. Marginals high, narrow, with one very long cutting point to the single cusp. Outer marginals about as high as wide, with one long inner, obtusely pointed, cutting point, and one shorter, outer cutting point. The first marginal teeth resemble those of *thyroides* in the single, greatly produced cutting point. The extreme marginals, however, are bifid. (Pl. VIII. Fig. R.)

The genital system in the specimens received was too decayed to allow of complete examination. The penis sac, however, was in perfect condition. It forms the peculiar feature of the system on account of its enormous development. It is short, cylindrical, with blunt ends, very stout, three or four times as large as the oviduct, with retractor muscle and vas deferens at its apex.

Mesodon dentifera, Binney.

Vol. III. Pl. XII.

Shell imperforate, flattened-convex on the upper surface, convex below; epidermis yellowish horn-color, immaculate; spire depressed; whorls 5, with delicate, parallel, oblique striæ; suture distinct, not deeply impressed; aperture contracted by the peristome, flattened towards the plane of the base; peristome thickened, white, broadly and abruptly reflected; parietal wall with a prominent, white, tooth-like process nearly parallel with the lower margin of the aperture, not projecting towards the umbilicus; base convex. Greater diameter 23, lesser 18 mill.; height, 10 mill.

Helix dentifera, Binney, Bost. Journ. Nat. Hist., I. 494, Pl. XXI. (1840); Terr. Moll., II. 134, Pl. XII. — Adams, Vermont Mollusca, 159 (1842). — Pfeiffer, Mon. Hel. Viv., I. 317. — W. G. Binney, Terr. Moll., IV. 55; L. & Fr.-W. Sh., I. 145 (1869). — DeKay, N. Y. Moll., 34, Pl. II. Fig. 17 (1843). — Mrs. Gray, Fig. of Moll. Ann., Pl. CXCI. Fig. 11, no descr. (from Bost. Journ.). — Morse, Amer. Nat., I. 99, Figs. 6, 7 (1867). — Gould and Binney, Inv. of Mass., ed. 2, 424 (1870). — Pfeiffer, Mon., V. 429 (1868). — Not of Pfeiffer, Vol. III. — Not of Chemnitz, ed. 2 (= *Roëmeri*).

From Maine to Virginia and to Ohio. It prefers mountainous country. It may be considered a species of the Northern Region, ranging into the Interior Region, especially along the Appalachian chain.

Readily distinguished from the allied species by the very angular and broad reflection of the peristome.

Animal grayish on the sides and posterior extremity, brownish on the upper parts, darker on the head and neck; foot long and narrow; eye-peduncles long and slender; eyes black. (See Bost. Journ. Nat. Hist., I. Pl. X.)

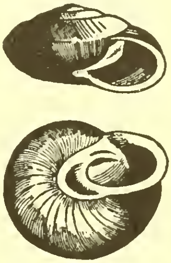
Jaw as usual in the genus; 14 ribs.

Lingual membrane (Pl. VIII. Fig. J) with 32—1—32 teeth, with 15 laterals.

Mesodon Roëmeri, PFEIFFER.

Shell with a narrow, or partially covered umbilicus, sometimes imperforate, depressed, rather thin, closely striated, rather transparent and smooth, horn-colored; spire slightly elevated; suture lightly impressed; whorls 5, rather convex, increasing slowly, the last one subcarinate at its periphery, scarcely descending; aperture lunar, oblique, generally slightly contracted by a parietal denticle which obliquely enters the mouth of the shell; peristome white, thickened, the upper portion hardly expanded, reflected below, and at the columellar junction spreading into a thin, partial covering to the umbilicus. Greater diameter 21, lesser 18 mill.; height, 10 mill.

Fig. 212.



M. Roemeri.

Helix Roëmeri, PFEIFFER in Roëmer's Texas, 455 (1849); Zeitschr. f. Mal. 1848, 117. — REEVE, Con. Icon., No. 680. — W. G. BINNEY, Terr. Moll., IV. 55; L. & Fr.-W. Sh., I. 146, Fig. 250 (1869).

Helix dentifera, part, PFEIFFER, Mon. Hel. Viv., III. 209; in CHEMNITZ, ed. II. 331, Pl. CXXXI. Figs. 1 - 3, not of BINNEY.

Mesodon Roëmeri, TRYON, Am. Journ. Conch., III. 43 (1867).

Near New Braunfels, Texas; Washington County, Williamson County, Bosque County, and Colorado River, Texas. A species of the Texas Subregion.

This species was formerly confounded by Pfeiffer with *dentifera*, an authentic specimen of which he had not seen. It is quite a distinct species, and inhabits a distinct geographical region. It may be distinguished from *dentifera* most readily by attention to the following particulars: Its umbilicus is generally but partially covered, while *dentifera* is always imperforate; its color is lighter, its surface smoother, and, above all, its peristome is not so broadly reflected; it is also distinctly subcarinate at the periphery.

Jaw as usual; 7 ribs on one, 9 on another specimen examined.

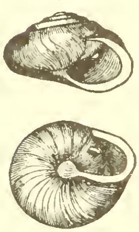
The lingual membrane (Pl. VIII. Fig. C) has 35—1—35 teeth, with 12 laterals. A few of the last laterals may have side cusps and cutting points.

The genitalia are figured on Pl. XI. Fig. J. The oviduct is scarcely convoluted. The genital bladder is large, oval, with a long, large duct. The penis sac is short, stout, of about equal breadth throughout, ending in a stout oval bulb, into which the vas deferens enters. The retractor muscle is inserted above the entrance of the vas deferens.

Mesodon Wetherbyi, BLAND.

Shell with umbilicus covered, orbicular-depressed, thin, granulately striate, pale horn-colored; epidermis dark, covered with oblique, prostrate hairs; spire somewhat conoidal, suture impressed, apex obtuse; whorls 5, slightly convex, gradually increasing, the last suddenly deflected, rather gibbous, constricted, beneath convex, subangulate at the periphery; aperture oblique, roundly lunate, with a white, erect, oblique, tongue-shaped parietal tooth; peristome thickened, angularly reflected, the upper margin expanded, the columellar margin dilated, covering the umbilical perforation. Greater diameter 17, lesser 15 mill.; altitude, 8 mill.

Fig. 213.



M. Wetherbyi.

Helix Wetherbyi, BLAND, Ann. Lyc. Nat. Hist. N. Y., X. 361, 1873.

At the base of sandstone cliffs, mouth of Laurel River, Whitley County, Kentucky. Probably a species of the Cumberland Subregion.

This species belongs to the same group as *dentifera*, Binney, and *Roëmeri*, Pfeiffer, but is of smaller size, somewhat more elevated, and readily distinguished from them by the sculpture and epidermis. It differs from *M. divesta*, Gould, in having a parietal tooth, and, although in general appearance like a small form of *M. appressa*, Say, is without the lamina on the basal margin of the peristome. (Bland.)

Jaw as usual in the genus; about 18 ribs.

Lingual membrane (Pl. VIII. Fig. D) with 35—1—35 teeth; 12 laterals. It will be seen in the figure that the marginal teeth have a simple, not bifid, inner cutting point, a peculiarity shared by only a few other species.

Genitalia unobserved.

Mesodon thyroides, SAY.

Vol. III. Pl. XL.

Shell narrowly umbilicated, depressed globose; spire convex; epidermis of a uniform yellowish-brown or russet color; whorls 5, with fine, parallel striæ, running obliquely across them; spire more or less elevated; suture distinctly impressed; aperture lunate, contracted by the peristome, the plane of the aperture making a considerable angle with the plane of the base of the shell; parietal wall with a prominent, white, tooth-like process placed obliquely to the axis of the shell; peristome white, thickened, widely reflected, and sometimes grooved on its face, its exterior yellowish; umbilicus exhibiting only one volution, partially covered by the reflected peristome where it unites with the base of the shell. Greater diameter 22, lesser 19½ mill.; height, 13 mill.

Helix thyroidus, SAY, Nich. Encycl. (Amer. ed.), 1817, 1818, 1819; Journ. Phil. Acad., I. 123 (1817); American Conchology (1831), No. 2, Pl. XIII; ed. BINNEY, 33, Pl. XIII; ed. CHENU, Bibl., 3, 22, Pl. III. Fig. 3. — EATON, Zoöl. Text-Book, 193 (1826). — FÉRUSSAC, Hist., Pl. XLIX. a, Fig. 4; Pl. L. a, Fig. 6? — DESHAYES, Encycl. Méth., II. 230 (1830); in LAM. An. sans Vert., VIII. 114; ed. 3, III. 309; in FÉR., I. 209. — BINNEY, Bost. Journ. Nat. Hist., I. 488, Pl. XVIII. (1837); Terr. Moll., II. 129, Pl. XI. — LEIDY, T. M. U. S., I. 257, Pl. XI. Figs. 7-9 (1851), anat. — DEKAY, N. Y. Moll., 29, Pl. II. Fig. 8. — GOULD, Invertebrata, 171, Fig. 108 (1841); ed. 2, 425 (1870). — ADAMS, Vermont Mollusca, 159 (1842). — MRS. GRAY, Fig. Moll. An., Pl. CCXCI. Fig. 6, from Bost. Journ., no descr.

Helix thyroides, PFEIFFER, Mon. Hel. Viv., I. 345; in CHEMNITZ, ed. 2, I. 331, Pl. LVIII. Figs. 8, 9 (1850). — REEVE, Con. Icon., No. 677. — W. G. BINNEY, Terr. Moll., IV. 53; L. & Fr.-W. Sh., I. 147, Fig. 251 (1869). — MORSE, Amer. Nat., I. 98, Fig. 3 (1867).

Anchistoma thyroides, H. & A. ADAMS, Gen. Pl. LXXVIII. Fig. 3, no descr.

Mesodon thyroides, TRYON, Am. Journ. Conch., III. 41 (1867).

Helix bucculenta, GOULD, Proc. Bost. Soc. Nat. Hist., III. 40 (1848); Terr. Moll. III. 9, Pl. XI. a. — PFEIFFER, Mon. Hel. Viv., III. 271; IV. 323. — W. G. BINNEY, Terr. Moll., IV. 54; L. & Fr.-W. Sh., I. 148, Fig. 254 (1869).

Helix thyroides, *β*, PFEIFFER, Mon. Hel. Viv., I. 345. — Var. FÉRUSSAC, Hist., Pl. L. a, Fig. 7.

Mesodon bucculenta, TRYON, Am. Journ. Conch., III. 41 (1867).

Animal: color a dirty yellowish-white, with a grayish hue in some individuals, eye-peduncles darker, eyes black, base of foot dirty white; foot rather narrow, terminated posteriorly in an acute angle. Length equal to twice the breadth of the shell. (See Bost. Journ. N. H., I. Pl. VII.)

A Post-pleiocene species now found over all the Eastern Province. The variation in size of the species is great. The smaller form (from near Philadelphia) is often found imperforate and toothless.

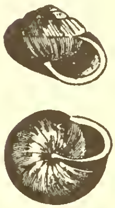
A reversed specimen was found by me at Graniteville, South Carolina.

Jaw long, narrow, slightly arcuate, with 13 stout ribs on both anterior and posterior surface, denticulating either margin.

The lingual membrane (Pl. VIII. Fig. S) has 60—1—60 teeth, with 11 laterals. This species is peculiar in having extremely long cutting points to the single cusp of its marginal teeth: the very extreme marginals have this cutting point bifid, and also have a small side cutting point. A similar dentition is found in *clausa* and *Wheatleyi*.

The genital system is figured by Leidy (l. c.). The penis sac is short, stout, cylindrical, receiving the vas deferens and retractor muscle at its summit; the genital bladder is small, elongated, bluntly tapering at its apex, on a short, narrow duct; the oviduct is greatly convoluted.

Fig. 214.

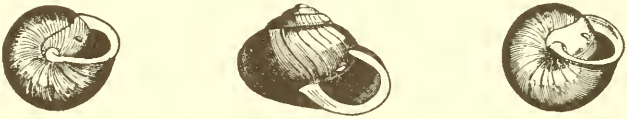


M. bucculenta.

In the Southern and Southwestern States from North Carolina to Texas, the species assumes often, not in all localities, the form described as *bucculenta*. I repeat the description and figures of the typical form, and a small variety from Alabama (Fig. 214). This last often wants the parietal tooth: this form has same jaw, lingual membrane, and genitalia as typical *thyroides*.

Shell usually perforate, globose-conic, more or less elevated, rather thin, shining, pale yellowish-green, surface regularly and delicately furrowed by the striæ of growth; whorls 5 or a little more, rounded, and separated by a well-impressed suture; base convex; aperture rounded; peristome forming nearly two thirds of a circle, rather broadly reflected, white, somewhat flesh-colored behind, not completely covering a small umbilical perforation, sometimes entirely covering it; parietal wall sometimes bears a small white tooth at the middle, but oftener not. Greater diameter 18½, lesser 15½ mill.; height, 10½ mill. (Vol. III. Pl. XI. a.)

Fig. 215.



M. bucculenta.

Mesodon clausa, Say.

Vol. III. Pl. IV., central figures.

Shell subimperforate, conoidly semiglobose, rather solid, with crowded riblike striæ, yellowish horn-color; spire subregularly conoid; whorls 5½, rather convex, gradually increasing, the penultimate subangular, the last rounded, anteriorly subconstricted and briefly deflected; umbilicus narrow, almost covered by the reflected peristome; aperture diagonal, subregularly lunate; peristome with a heavy, white thickening, uniformly subangularly reflected, its columellar portion subdilated. Greater diameter 18½, lesser 16 mill.; height, 11½ mill.

Helix clausa, Say, Journ. Phila. Acad., II. 154 (1821); American Conch. (1832), No. 4, Pl. XXXVII. Fig. 1; Binney's ed., 17, Pl. XXXVII. Fig. 1; ed. Chenu, Bibl. Conch., III. 50, Pl. XIII. Fig. 2. — Binney, Bost. Journ. Nat. Hist., I. 482, Pl. XV. (1837); Terr. Moll., II. 107 (excl. syn.), Pl. IV. (excepting the outline figures). — DeKay, N. Y. Moll., 31, Pl. III. Fig. 13 (1843). — Reeve, Con. Icon., Fig. 694. — Bland, Ann. N. Y. Lyc., VI. 336. — Pfeiffer, Mon. Hel. Viv., IV. 321. — W. G. Binney, Terr. Moll., IV. 46; L. & Fr.-W. Sh., I. 149 (1869).

Helix Pennsylvanica, Pfeiffer, ex parte, Symb. ad. Hist. Hel., II. 36; Mon.

Hel. Viv., I. 291 ; in Chemnitz, ed. 2, II. 51, ex parte. — Reeve, ex parte, Con. Icon., No. 676 ; not of Green.

Helix Mitchelliana, Pfeiffer in Chemnitz, l. c. I. 332, Pl. LVI. Figs. 6 - 8.

Mesodon clausa, Tryon, Am. Journ. Conch., III. 47 (1867).

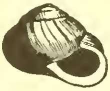
A Post-pleiocene species now found in the Interior Region, in the States bordering on the Ohio River, and in Wisconsin, Missouri, Tennessee, Mississippi, and Alabama.

Animal blackish.

In *M. clausa* the umbilical region is more widely excavated, and the groove behind the reflected peristome, producing the contraction of the aperture, is continued at the base of the shell, becoming wider as it joins the umbilical opening. In *M. Mitchelliana* the groove is almost obliterated at the point of reflection of the peristome over the umbilicus, by the more tumid character of the last whorl.

H. Ingallsiana, Shuttleworth (*Jugallsiana* of Albers ed. 2), is a small form of *clausa*. I give a figure copied from an unpublished plate of Shuttleworth.

Fig. 216.



M. Ingallsiana (Shuttleworth).

Jaw as usual in the genus; about 10 stout ribs.

Lingual membrane as in *M. thyroides* (Pl. VII. Fig. T) ; it has 41—1—41 teeth, with about 11 perfect laterals. I can detect no side cusps, even on the extreme outer marginals.

The genitalia are figured on Pl. XIV. Fig. G. The penis sac is the conspicuous feature of the system : it is longer than the oviduct, and almost as stout, of about equal size throughout; it has the entrance of the vas deferens and retractor muscle at its blunt apex. The genital bladder is small, lengthened oval, with a long, slender duct. The prostate is narrow, stout, prominent, cordlike. The vas deferens is large. The other organs present no peculiar features.

Mesodon Columbiana, Lea.

Vol. III. Pl. V.

Shell umbilicated, subdepressed-globose; epidermis with short, rigid hairs, corneous, thin ; whorls 6, slightly rounded, very minutely striated, rising gradually, but regularly, one above the other to an acuminated apex; suture strongly impressed; aperture roundly lunate, a little contracted and thickened by a testaceous deposit or border, at the angle of reflection of the peristome; peristome thickened, whitish, or brownish white, reflected but not flattened, rather grooved on its face, the basal margin horizontal in its direction, with a slight thickening or projection before it reaches the base of the shell; umbilicus open, partially hidden by the reflected peristome at its junction with the base; base a little flattened. Greater diameter 17, lesser 14 mill.; height, 11 mill.

Helix Columbiana, Lea, Am. Phil. Soc. Trans., VI. 89, Pl. XXIII. Fig. 75 ; Obs., II. 89 (1839); in Troschel, Arch. f. Nat., 1839, II. 221. — DeKay, N. Y.

Moll., 46 (1843). — PFEIFFER, Mon. Hel. Viv., I. 343; in CHEMNITZ, ed. 2, I. 332, Pl. LVIII. Figs. 10-12 (1846). — REEVE, Con. Icon., No. 692 (1852). — BINNEY, Terr. Moll., II. 169, Pl. V. — W. G. BINNEY, Terr. Moll., IV. 16; L. & Fr.-W. Sh., I. 150 (1869).

Helix labiosa, GOULD, Proc. Bost. Soc. Nat. Hist., II. 165 (1846); U. S. Expl. Exped. Moll., 67, Fig. 35 (1852); Terr. Moll., II. 170, Pl. XIII. a, Fig. 1. — PFEIFFER, Mon. Hel. Viv., I. 343 (included in *Columbiana* in Vol. V.).

Mesodon Columbiana, TRYON, Am. Journ. Conch., III. 46 (1867).

A species of the Pacific province ranging from Sitka and Fort Simpson (lat. 54° 40′) to Santa Cruz in California (lat. 37° 20′).

Animal slender, eye-peduncles and tentacles much elongated. Color pale ferruginous, with a lilac tint, darker on the neck. Whole surface, even the eye-peduncles, marked with coarse, elliptical granules, in longitudinal series; no marginal border.

There is a variety with a well-developed parietal tooth.

I formerly had difficulty in separating certain forms of *Mesodon Columbiana*, Lea, and *Stenotrema germanum*, Gould, but have recently received, through the kindness of Mr. Henry Hemphill, specimens of both species, preserved in alcohol, from several distinct localities. An examination of their soft parts has proved that in the jaw and genital system there exists a specific difference readily detected. This difference appears to be constant, as I have observed it in one specimen, with parietal lamina and quite depressed, of *Columbiana*, from San Leandro, California, and three from another locality. In *germanum* I also have found the characters constant, having examined four specimens, one from Astoria, the other three from a separate locality.

In the jaw the distinction is in its general outline and in the size and frequency of the ribs on the anterior surface. In *germanum* the jaw is slightly arcuate; the ribs are about 11 in number, broad, crowded, with narrow interstices only, generally resembling the jaw found in *Stenotrema*. In *Columbiana* the jaw is more arched, the ribs are less numerous, about 8, narrower, much more separated, and more decidedly produced on either margin, as usual in *Mesodon*. For figures of the jaw of each see Ann. N. Y. Lyc. Nat. Hist. X. Pl. XIV.

In the genitalia the difference lies in the genital bladder. This organ in *Columbiana* (Pl. XI. Fig. I) is clavate, short, with a short, stout duct, but in *germanum* (Fig. M) it is globular, and has a long, narrow duct.

In both species the retractor muscle of the penis is attached to the vas deferens a short distance before the latter organ enters the penis sac, which it does at the apex of the latter.

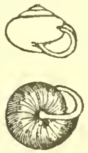
Jaw (see above).

Lingual membrane (Pl. VIII. Fig. P) with 33—1—33 teeth; 15 laterals, the sixteenth tooth having a bifid cutting point. There are decided side cusps and cutting points to the central and lateral teeth.

Mesodon Downieana, Bland.

Shell umbilicate, umbilicus nearly covered, subglobose, thin, subpellucid, with obsolete rib-like striæ, decussated with crowded microscopic spiral lines, greenish horn-colored; spire short, obtuse; whorls 5, convex, the last tumid, anteriorly somewhat gibbous, scarcely descending, constricted; aperture oblique, lunate oval; peristome white, labiate, reflected, right margin expanded, columellar margin angularly dilated, nearly covering the umbilicus. Greater diameter 10½, lesser 9½ mill.; height, 6 mill.

Fig. 217.



M. Downieana.

Helix Downieana, Bland, Ann. N. Y. Lyc., VII. 420, Pl. IV. Figs. 23, 24 (1861). — W. G. Binney, L. & Fr.-W. Sh., I. 151 (1869).
Mesodon Downieana, Tryon, Am. Journ. Conch., III. 47 (1867).

Munroe County; University Place, Franklin County; Tennessee, Whitley County, Kentucky. A species of the Cumberland Subregion.

Animal with the usual characters of the genus.

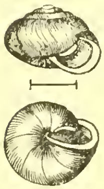
Jaw as usual; over 10 ribs.

The lingual membrane (Pl. VIII. Fig. F) has 35—1—35 teeth, with 12 laterals. The side cusps and cutting points are visible on the second lateral tooth.

Mesodon Lawi, Lewis.

Shell narrowly umbilicated, globose, surface hardly broken by delicate incremental striæ, horn-colored; spire elevated, apex obtuse; whorls 4, convex, suture impressed, the last globose, descending, deeply constricted behind the peristome; aperture oblique, lunate, narrow, with a linguiform tooth on the parietal wall; peristome white, thickened, reflected, its terminations approached slightly, that of the columellar somewhat concealing the very narrow umbilicus. Greater diameter 6, lesser 5 mill.; height, 3 mill.

Fig. 218.



M. Lawi.

Helix Lawi, Lewis, Proc. Acad. Nat. Sci. Philad., 1874, 118 (Fig.).

Probably a species of the Cumberland Subregion. Thus far only found at Hayesville, Clay County, North Carolina, in a field, at the roots of Strawberry plants, by Miss Annie M. Law.

Animal unobserved.

Mesodon jejuna, Say.

Vol. III. Pl. XLII. Fig. 2.

Shell umbilicated, subglobose; epidermis corneous, nearly smooth; spire rather prominent; suture impressed; whorls rather more than 5, the last ample; striæ of increase hardly visible; peristome white, very narrow, reflected, a deep groove behind it; aperture well rounded, semicircular, considerably contracted by the impressed groove behind the peristome, and a corresponding testaceous deposit, or rib, within; umbilicus small, round, not expanded; umbilical region not impressed; base convex. Greater diameter 8, lesser 7 mill.; height 4½ mill.

Helix jejuna, SAY, Journ. Phila. Acad., II. 158 (1821); BINNEY'S ed., 9. — DE KAY, N. Y. Moll., 46. — PFEIFFER, Mon. Hel. Viv., I. 147. — BLAND, Ann. N. Y. Lyc., VI. 341 (1858). — W. G. BINNEY, Terr. Moll., IV. 67.

Hygromia jejuna, TRYON, Am. Journ. Conch., II. 308 (1866).

A species of the Florida Subregion, found originally near Jacksonville, Florida,[1] received by me from Indian River and St. Augustine, Florida, and noticed as far north as Savannah, Georgia.

Animal dirty white, neck darker, eye-peduncles black, — not quite twice the breadth of the shell, — foot pointed.

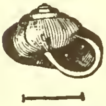
Nearly allied to *M. Mobiliana* (q. v.), with which it is confounded in Vol. II.

Jaw, lingual dentition, and genitalia unknown.

Mesodon Mobiliana, LEA.

Shell globose, perforated, thin, smooth, with very delicate incremental striæ, horn-colored; whorls 6, convex; suture impressed, last whorl tumid below, globose, slightly descending, deeply constricted behind the peristome, umbilical region scarcely excavated; apex obtuse; spire elevated; aperture oblique, rounded; peristome thickened, white, reflected, its terminations distant, that of the columellar somewhat concealing the perforation. Greater diameter 8½, lesser 6 mill.; height, 5 mill.

Fig. 219.



M. Mobiliana.

Helix Mobiliana, LEA, Proc. Am. Phil. Soc., II. 82 (1841); Trans. Am. Phil. Soc., IX. 17; Obs., IV. 17 (1844); in TROSCHEL, Arch. f. Nat. 1843, II. 124. — PFEIFFER, Mon. Hel. Viv., I. 323; IV. 122. — BINNEY, Terr. Moll., II. 172, Pl. XLII. Fig. 2, part.

A species of the Southern Region, received from near Mobile, and from Baldwin, Florida.

It has heretofore been confounded with *M. jejuna* (q. v.). It must be borne in mind that the figures in Terr. Moll., Pl. XLII. Fig. 2, and Land and Fresh-water Shells, Fig. 258, are of *jejuna*, and do not represent Lea's species.

In *M. Mobiliana* there are 6 whorls; the last whorl is remarkably constricted and gibbous at the aperture, more tumid at the base and with smaller umbilicus than in *jejuna*. The microscopic spiral lines on the embryonic whorls of the latter are absent in the former. The peristome at its junction with the penultimate whorl is sharp, not reflected nor thickened, but elsewhere reflected, thickened by a whitish callus within, the edge of which forms a distinct portion of the peristome, and has an obsolete tooth-like development near the columella. The aperture is more lunate than in *jejuna*.

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[1] The Cow Ford (not Cowfort) of the St. John's River, given by Mr. Say as the original locality.

M. Mobiliana may be compared, so far as regards the tumid base, small umbilicus, constricted aperture, and gibbous character of the superior part of the last whorl behind the aperture, with a Texan form in my cabinet of *Dorcasia Berlandieriana*.

The measurements of my largest specimen (6 whorls) of *M. Mobiliana*, from Baldwin, are as follows: Greater diameter 10, lesser 7 mill.; height, 6 mill.

Jaw as usual; 10 ribs.

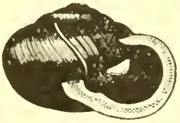
Lingual membrane of the true species, from Baldwin County, Alabama, has 25—1—25 teeth, with 10 perfect laterals. There are decided side cusps and cutting points to centrals and laterals; the transition to the marginals is made as usual, the inner cutting point becoming bifid. Pl. VIII. Fig. N.

Genitalia unobserved.

Mesodon devia, Gould.

Shell umbilicated, solid, depressed-globose, pale yellowish horn-color, or brown, with fine lines of growth; whorls 6, convex, suture well defined; beneath slightly convex, and perforated by a moderate-sized umbilicus, which appears to have an obtuse channel revolving on the whorls within it; periphery rounded; aperture transverse, obliquely lunate; peristome thickened, white, or sometimes rufous, rather broadly reflected, horizontal at base, the upper edge sometimes bearing a tooth-like process, the inner edge dilated into an elongated, lamellar, white, tooth-like process, and abruptly turning up to form a short columella, where it dilates, and partly surrounds the umbilicus; near the upper margin, and on the parietal wall, is a white trigonal tooth. Greater diameter 24, lesser 19 mill.; height, 14 mill.

Fig. 220.



M. devia.

Helix devia, Gould, Proc. Bost. Soc. Nat. Hist., II. 165 (1846); Terr. Moll., III. 11; Moll. of Expl. Exped., 69, Fig. 74, Addenda, *501 (1852). — Pfeiffer, Mon. Hel. Viv., I. 383. — W. G. Binney, Terr. Moll., IV. 17, Pl. LXXIX. Fig. 13; L. & Fr.-W. Sh., I. 152 (1869).

Helix Baskervillei, Pfeiffer, Proc. Zoöl. Soc., 1849; Mon. Hel. Viv., III. 230, in V. referred to *devia*. — Reeve, Con. Icon., Fig. 684.

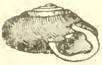
Mesodon devia, Tryon, Am. Journ. Conch., III. 42 (1867).

Helix Mullani, Bland and Cooper, Ann. N. Y. Lyc., VII. 363, Pl. IV. Figs. 16, 17 (1861).—W. G. Binney, L. & Fr.-W. Sh., I. 130 (1869).

Triodopsis Mullani, Tryon, Am. Journ. Conch., III. 52 (1867).

An Oregonian Region species, ranging from 46° to 49° latitude. It also has crossed the Cascade Mountains, ranging southeasterly into the Central Province as far as the Cœur d'Alene Mountains, and Salmon River, Idaho. At the latter localities it is smaller and much less globose, and has its aperture decidedly tridentate. This form is figured here. It was also described by Mr. Bland as *H. Mullani*, his type being more globose. I am convinced of the identity of the two forms, but repeat his description and his figures.

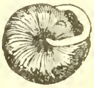
Fig. 221.



M. devia, var.

Helix Mullani, Bland. — Shell with umbilicus partially covered, globose-depressed, dark horn-colored, irregularly striated, having a thin epidermis with microscopic spiral lines, and tubercles (the latter with hairs?); beneath the epidermis shining; spire short; whorls 5½ to 6, convex, the last gibbous above, scarcely descending, the base rather smooth, much constricted at the aperture; aperture subtriangular, oblique, with a short, white, linguiform, parietal tooth; peristome white, or reddish horn-colored, thickened, expanded, and roundly reflected, with 2 teeth on the margin of the callus, the lower one lamelliform, the other small, often obsolete, the columellar margin partially covering the middle-sized, pervious umbilicus. Greater diameter 13½, lesser 11 mill.; height, 7 mill.

Fig. 222.



Helix Mullani.

Jaw (of the Salmon River form) as usual in the genus, with 7 stout ribs.

The lingual membrane of the same (Pl. VIII. Fig. O) has 23—1—23 teeth, with 16 perfect laterals.

Genitalia and lingual dentition of the typical form (see Appendix).

Mesodon profunda, Say.

Vol. III. Pl. XXII.

Shell broadly umbilicated, orbicularly depressed; epidermis yellowish horn-color, with reddish-brown, revolving lines and bands, sometimes uniformly brown or albino; whorls from 5 to 6, convex, obliquely striated with delicate and regular raised striæ; suture distinct; aperture almost circular, a little contracted by the peristome, flattened towards the plane of the base; peristome white, thickened, reflected, with a slightly prominent callus, or obtuse tooth, on the inner edge near the base; umbilicus rather large and profound, exhibiting all the volutions to the apex; base convex, with the striæ converging into the umbilicus. Greater diameter 29, lesser 24 mill.; height, 14 mill.

Helix profunda, Say, Journ. Phila. Acad., II. 160 (1821); American Conchology, No. 4, Pl. XXXVII. Fig. 3; ed. Binney, 20, 36, Pl. XXXVII. Fig. 3; ed. Chenu, III. 51, Pl. XIII. Fig. 2, b, 2, c. — DeKay, N. Y. Moll., 42, Pl. III. Fig. 3. — Leidy, T. M. U. S., I. 255, Pl. IX. Figs. 1-3, anat. — Binney, Bost. Journ. Nat. Hist., III. 377, Pl. XV; Terr. Moll., II. 177, Pl. XXII. — Pfeiffer, Mon. Hel. Viv., I. 382; in Chemnitz, ed. 2, II. 63, Pl. LXXVII. Figs. 14-16. — Deshayes in Fér., I. 69. — Mrs. Gray, Fig. Moll. An., Pl.

[illegible] Fig. [illegible] — Reeve, Con. Icon., [illegible] — W. G. Binney, Terr. Moll., IV. 70. — [illegible] Fr.-W. [illegible], [illegible] 152 (1869).
Helix Richardi, Férussac, Tab. Syst. 43; Hist., Pl. LXX. three lower figs. — Lamarck, An. s. Vert., VI. 72. — Deshayes, Encycl. Méth., II. 212; in Lam., VIII. 40; ed. 3, III. 283. — Chenu, Ill. Conch., Pl. XII. Fig. 13. — Delessert, Rec. des Coq., Pl. XXVI. Fig. 7.
Junior? Helix bulbina, Deshayes in Fér. Hist., I. 108, Pl. LXXXV. Figs. 14–18. — Pfeiffer, Mon. Hel. Viv., III. 201. — W. G. Binney, Terr. Moll., IV. 116, Pl. LXXIX. Fig. 10.
Ulostoma profunda, Tryon, Am. Journ. Conch., III. 37 (1867).

A Post-pleiocene species, now found in the Interior Region; from Western New York to Minnesota, Virginia to Kansas.

Animal light brown, darker on the head, neck, eye-peduncles, and tentacles, and pale on the posterior extremity; foot rather thick, in length less than twice the diameter of the shell, terminating acutely. (See Bost. Journ. Nat. Hist., I. Pl. XV.)

Jaw arcuate, of uniform width, ends blunt; anterior surface crowded with 10 stout ribs, denticulating either margin.

The lingual membrane (Pl. VIII. Fig. Q) has 40—1—40 teeth, with about 14 perfect laterals, but the change from laterals to marginals is very gradual, being made without splitting of the inner cutting point, which is simple on the extreme marginals even.

Genitalia figured by Leidy (l. c.). The penis sac is not very stout, long, receiving the retractor muscle at about the middle of its length, and tapering very gradually towards its summit into the vas deferens; genital bladder large, globose-oval, on a long, narrow duct. The penis sac is very different from that of *M. Sayii*.

Mesodon Sayii, Binney.[1]

Vol. III. Pl. XXIII.

Shell umbilicated, orbicularly depressed, thin; epidermis light russet, shining; whorls between 5 and 6, with numerous fine, oblique striæ; suture impressed; aperture lunately subcircular, not dilated; peristome white, narrow, thickened, reflected, with a slightly projecting tooth on the inner edge of the basal portion near the umbilicus; parietal wall with a sub-prominent, white tooth; umbilicus open, deep, not wide, exhibiting all the volutions, slightly contracted by the reflected peristome; base rounded, with the striæ distinct, converging into the umbilicus. Greater diameter 27,[2] lesser 23 mill.; height, 17 mill.

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[1] The name *diodonta*, which has not precedence in the genus *Helix*, may be adopted in *Mesodon* by those who follow the strict laws of nomenclature; I doubt myself the propriety of changing the long-established name in any of the genera formed from disintegrated *Helix*.

[2] One specimen measured 41 mill.

Helix diodonta, SAY, Long's Exped., II. 257, Pl. XV. Fig. 4 (1824); ed. BINNEY, 39, Pl. LXXIV. Fig. 4. — DEKAY, N. Y. Moll., 34, Pl. II. Fig. 18. — DESHAYES in FÉR., Pl. LXIX. 1, Fig. 2.

Helix Sayi, BINNEY, Bost. Journ. Nat. Hist., III. 379, Pl. XVI. (1840); Terr. Moll., II. 180, Pl. XXIII. — ADAMS, Vermont Mollusca, 160 (1842). — W. G. BINNEY, Terr. Moll., IV. 70; L. & Fr.-W. Sh., I. 153 (1869). — PFEIFFER, Mon. Hel. Viv., I. 382; in CHEMNITZ, ed. 2, III. 419, Tab. CXLVIII. Figs. 13, 14. — LEIDY, T. M. U. S., I. 256, Pl. XI. Figs. 1-4 (1851), anat. — MRS. GRAY, Fig. Moll. An., Pl. CXCIII. Fig. 10, from Bost. Journ., no descr. — DESHAYES in FÉR., I. 79. — REEVE, Con. Icon., No. 679 (1852). — MORSE, Amer. Nat., I. 98, Figs. 4, 5 (1867). — GOULD and BINNEY, Inv. of Mass., ed. 2, 426 (1870). — LEWIS, Am. Journ. Conch., VI. 191, Pl. XIII. Figs. 5-7 (1871).

Mesodon Sayii, MORSE, Journ. Portl. Soc., I. 9, Fig. 9, Pl. IV. Fig. 10 (1864).

Ulostoma Sayii, TRYON, Am. Journ. Conch., III. 38 (1867).

Northern and Interior Regions. From Canada East to Michigan, Maryland, Kentucky, and Tennessee, — in the last locality greatly developed, a specimen figured by Lewis (l. c.), measuring 1.40 inches.[1]

Animal light reddish-brown, eye-peduncles and tentacles smoky, eyes black; head and neck cylindrical, foot narrow, terminating in an acute point; length about twice the diameter of the shell. (See Bost. Journ. Nat. Hist., I. Pl. XVI.)

On the 3d day of July, 1836, Dr. Binney discovered an individual of this species in the act of laying its eggs in a damp place under a log. He transferred them with the animal to a tin box filled with wet moss. The eggs were not much more than half as large as those of *M. albolabris*, Say; they were white, adhering together very slightly, flaccid, and apparently not entirely filled with fluid. During the succeeding night the number had increased to about fifty, and in a few hours they became full and distended. As the snail now began to devour the eggs, he was obliged to remove it. On the 29th of July all the eggs were hatched; the young snails had 1½ whorls; the umbilicus was open; the head, eye-peduncles, and tentacles were bluish-black, and the other parts whitish and semi-transparent. They immediately began to feed, and made their first repast of the pellicle of the eggs from which they had just emerged. They grew rapidly, and before the middle of October, when they went into winter-quarters, they had increased their bulk four or five times beyond its original measurement.

Jaw as usual in the genus; 15 ribs. (See next page.)

The lingual membrane (Pl. VIII. Fig. B) has 42—1—42 teeth, with about

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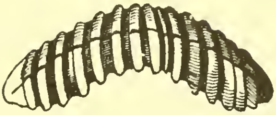
[1] "*H. Chilhoweensis* differs from typical *Sayii* in having a cubic capacity more than five times as great, smaller or more rudimentary teeth, a wider development of the reflected lip on the base, and in several other less important details. The greatest diameter of the most perfect shell before me is about 1.40 inches." — LEWIS. See also Proc. Acad. Nat. Sci. Phila., 1875, 334.

15 perfect laterals; the change from laterals to marginals is made without the splitting of the inner cutting point. The centrals and first laterals have no distinct side cusps and cutting points.

Genital system (see Leidy, l. c.) very remarkable for the enormous development of the penis sac; it is stout, cylindrical, as long as the whole genital system, receiving both retractor muscle and vas deferens at its summit; genital bladder large, elongate ovate, on a very short duct.

Fig. 223.



Jaw of *M. Sayii* (Morse).

ACANTHINULA, Beck.

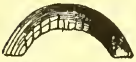
Animal heliciform; mantle posterior; other characters as in *Patula* (see below, Fig. 226).

Shell perforated, globosely turbinated, with a brownish plicately ribbed or aculeate epidermis; whorls 4 – 5; aperture rounded; peristome thin, somewhat expanded, its terminations approached.

In Europe this genus is found at the north, but one species ranges as far south as Palermo. Our single species is probably circumpolar, common to the three continents.

We have but one species within our limits, *A. harpa*, whose jaw and lingual dentition have been described and figured by Morse. Judging from his figure (Fig. 224) and text, the anterior surface of the jaw seems to have subobsolete ribs which mark the lower margin; it is low, wide, strongly arched, with blunt, scarcely attenuated ends; cutting edge with a wide and very slightly produced, broad median projection; transversely and longitudinally striate.

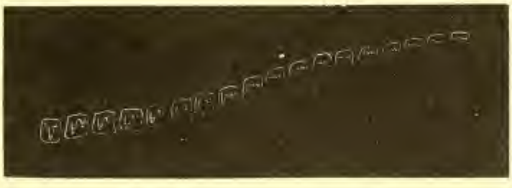
Fig. 224.



Jaw of *A. harpa* (Morse).

Lingual membrane long and narrow, 120 rows of 17—1—17 teeth, with 6 perfect laterals. The centrals have a square base of attachment, the upper margin squarely reflected; the reflection is very small, tricuspid, the side cusps very small, blunt, the median cusps very long and narrow, not reaching the lower edge of the base of attachment, not even with its short cutting point;

Fig. 225.



Lingual dentition of *A. harpa* (Morse).

side cusps also, I presume, with cutting points, though none are shown in Morse's figure. Laterals like the centrals, but asymmetrical by the suppression of the inner side cusps and cutting points. Marginals low, wide, the broad reflection equalling the base of attachment and irregularly denticulated, as in *Pupa*.

There are two European species of this genus, *A. aculeata* and *lamellata*, whose jaw is described by Lehmann as rather striated than ribbed. Their lingual dentition presents no generic differences from that of *harpa*, though the cusps of the centrals are described as simply conical.

Acanthinula harpa, SAY.

Vol. III. Pl. LII. Fig. 3.

Shell subperforate, ovately conic, transparent, very thin, with coarse, irregular lines of growth, pellucid, light horn-color; spire conical, rather obtuse; whorls 4, convex, the upper ones smooth, the two last with prominent, distant, thin, colorless, fold-like ribs, slightly inclined backwards, the last whorl rounded, somewhat longer than the spire; columella subreceding; aperture lunately oval; peristome simple, straight, its columellar termination briefly reflected above. Greater diameter, 2 mill.; length, $3\frac{1}{2}$ mill.; aperture, $1\frac{2}{3}$ mill. long, $1\frac{1}{4}$ mill. wide.

Helix harpa, SAY, Long's Exped., II. 256, Pl. XV. Fig. 1 (1824); BINNEY's ed., 29, Pl. LXXIV. Fig. 1. — W. G. BINNEY, L. & Fr.-W. Sh., I. 156 (1869). — GOULD and BINNEY, Inv. of Mass., ed. 2, 427 (1870).

Pupa costulata, MIGHELS, Proc. Bost. Soc. Nat. Hist., I. 187 (1844).

Bulimus harpa, PFEIFFER, Zeitschr. f. Malak., 1847, 147; Mon. Hel. Viv., II. 150; in CHEMNITZ, ed. 2, No. 305, Pl. LX. Figs. 17-19. — REEVE, Con. Icon., No. 596 (1849). — BINNEY, Terr. Moll., II. 290, Pl. LII. Fig. 3. — W. G. BINNEY, Terr. Moll., IV. 135.

Zoögenites harpa, MORSE, Journ. Portl. Soc., I. 32, Pl. I. Figs. 1-14 (1864); Amer. Nat., I. 608, Figs. 50, 51 (1868). — TRYON, Am. Journ. Conch., III. 311 (1868).

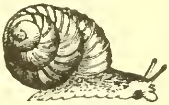
Helix Amurensis, GERSTF., teste MÖRCH.

A circumpolar species, in our country found in the Northern Region. — Gaspé; Maine; New Hampshire. Originally found by Say on the expedition to St. Peter's River, etc. In British America, English River, and James' Bay; in Europe, Sweden (Mal. Blätt. 1867, p. 200), Norway, Lapland, etc.; in Asia, Petropaulouski in Kamtschatka.

Animal small, compared to the size of the shell; body and head slate-color, eye-peduncles darker, short, thick, bulbous; eyes large, distinct; foot but two thirds length of shell, whitish; the body, disk, and mantle are marked with white dots, the edge of the mantle is of the same color as the head and eye-peduncles. The disk is rounded posteriorly, and broad and truncated anteriorly; the lateral borders are deeply crenulated. The head is separate from the disk, as in the

Pupa, bearing two minutely crenulated lappets, which hang down on either side of the mouth like a visor, reminding one of the oblique folds on the head of *Glandina truncata*, which we believe to be homologous to them. A longitudinal furrow extends from the mouth downward. The body is so translucent that when extended the ganglionic centres can be plainly seen. In motion it is exceedingly graceful, at times poising its beautiful shell high above its body, and twirling it around, not unlike the *Physa*, again hugging its pretty harp close to its body; the shell, when in this last position, continually oscillates, as if the animal could not balance it; it rarely ever moves in a straight line, but is always turning and whisking about, and this is done at times very quickly and abruptly. (Morse.)

Fig. 226.



Animal of *Helix harpa*.

Jaw and lingual membrane (see above).

The species is said by Mr. Morse to be viviparous.

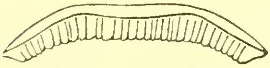
VALLONIA, Risso.

Animal heliciform (see Bost. Journ. Nat. Hist., I. Pl. IX. Fig. 2); other characters as in *Patula*.

Shell umbilicated, depressed, diaphanous, whorls $3\frac{1}{2} - 4$; aperture oblique, subcircular; peristome white, thickened, reflected, its margins contiguous or converging.

The single known species is circumpolar, common to the three continents. In North America its range is shown below (p. 344); in Europe it is found everywhere, reaching indeed Northern Africa, the Azores, Madeira, etc.; in Asia it occurs in Siberia, Thibet. This wide distribution, so unusual in the land shells, suggests great antiquity for the species. It is said to have been found in the Red and Norwich Crag (see Prestwich, Quart. Journ. Geol. Soc., XXVII. 493).

Fig. 227.



Jaw of *V. pulchella* (Morse).

Jaw low, wide, slightly arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous crowded, broad ribs, denticulating the lower margin (Fig. 227).

Lingual membrane (Pl. VII. Fig. U) long and narrow, arranged as in *Patula*. Morse gives 73 rows of 11—1—11 teeth, with 3 perfect laterals. I counted 10—1—10, with 3 perfect laterals. Centrals with the base of attachment long and narrow, expanded and notched at the outer lower angles, narrowed above and reflected; reflection very small, tricuspid, all the cusps bearing very short cutting points, the central one, as usual, longest. Laterals with the base of attachment twice as broad as in the centrals, the inner lower angle suppressed, notched at the outer angle, broadly reflected above; reflection larger than in the centrals, with one inner, long, slender cusp, reaching nearly the lower edge of the base of attachment, its cutting point quite reaching it, and one small outer side cusp, also bearing a distinct cutting point. Marginals low, wide, the reflection equalling the base of attachment and irregularly denticulated along its edge, the inner cusp the longest and bifid. The dentition is quite that of *Pupa*.

The above description is drawn from a specimen from Maine. The European form is figured by Moquin-Tandon with a median projection to the cutting edge of its jaw. Lehmann also figures a wide, slight projection to the cutting edge. A comparison of the description and figure of the dentition of the European specimens given by Thomson and Lehmann shows no specific difference. It will be noticed that Lehmann's figure of the centrals shows a more developed reflection and cusp and no side cusps. I believe, however, that careful comparison will show no variation in this or other particulars.

Vallonia pulchella, MÜLLER.

Vol. III. Pl. IX. Fig. 2.

Shell widely umbilicated, depressed, slightly convex above, thin and transparent; epidermis colorless; whorls 4, very minutely striated, the last large, and spreading at the aperture like a trumpet; aperture orbicular, a little dilated; peristome much thickened, white, reflected, making nearly a continuous circle, ends approaching; umbilicus large, exhibiting all the volutions. Greater diameter 3, lesser $2\frac{1}{2}$ mill.; height, $1\frac{1}{2}$ mill.

Helix pulchella, MÜLLER, Verm., 30. — PFEIFFER, Mon. Hel. Viv., I. 365. — BINNEY, Bost. Journ. Nat. Hist., III. 375, Pl. IX. Fig. 2 (1840); Terr. Moll., II. 175, Pl. XVII. Fig. 1. — LEIDY, T. M. U. S., I. 256, Pl. IX. Figs. 7-9 (1851), anat. — GOULD, Invertebrata, 176, Fig. 102 (1841), ed. 2, 429 (1870). — ADAMS, Vermont Mollusca, 159 (1842). — W. G. BINNEY, L. & Fr.-W. Sh., I. 157 (1869).

Helix minuta, SAY, Journ. Phil. Acad., I. 123 (1817); Nich. Encycl., ed. 3 (1819); BINNEY'S ed., 3. — DEKAY, N. Y. Moll., 40, Pl. III. Fig. 33 (1843). — MORSE, Am. Nat., I. 544, Fig. 39 (1867).

Helix costata, MÜLLER, *vid.* PFEIFFER, Mon. Hel. Viv., I. 366.

Vallonia minuta, MORSE, Journ. Portl. Soc., I. 21, Figs. 54-56, Pl. VIII. Fig. 57 (1864). — TRYON, Am. Journ. Conch., III. 36 (1867).

A circumpolar species, common to the three continents. From Canada East to Nebraska and Florida in the Eastern Province, to New Mexico in the Central Province, as well as in Nevada, Idaho, Arizona, and Colorado. For its range in Europe and Asia see p. 343.

The strongly ribbed variety (*V. costata*) has been found in large numbers in Kansas, and at Cincinnati and Philadelphia, and in Nevada.

Jaw and lingual membrane described above.

Genitalia figured by Lehmann (Lebenden Schnecken, Pl. XI. Fig. 30).

Penis sac cylindrical, receiving the vas deferens and retractor muscle at its apex; genital bladder globose, large, on a long narrow duct; opposite the entrance of the latter into the vagina is a small sac-like receptacle for a dart.

The Museum of Comparative Zoölogy has a reversed individual.

FRUTICICOLA, Held.

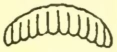
Animal heliciform; mantle subcentral; other characters as in *Patula*.

Shell umbilicated or perforated; depressed-globose, sometimes pilose; whorls 5 – 7, rather convex; aperture broadly lunate or lunate-rounded, peristome acute, very briefly expanded, labiate within, its basal margin reflexed.

A European genus, of which two species have been introduced within our limits by commerce.

The two species of this subgenus found within our limits, *rufescens* and *hispida*, are purely local, having been introduced by commerce at Quebec and Halifax, respectively. I have not had an opportunity of examining the latter. The jaw of the subgenus is described as arcuate with blunt ends; anterior surface with broad, crowded ribs (see figure of that of *hispida* copied from Moquin-Tandon); Lehmann (l. c., Pl. XII. Fig. 57) figures the lingual membrane of *hispida* with centrals having a long narrow base of attachment, a stout, pear-shaped, unicuspid reflection; laterals bicuspid, marginals a simple modification of the laterals. I do not find it so in *rufescens* (see below). Other species are also figured by Lehmann.

Fig. 228.



Jaw of *F. hispida.*

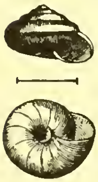
Fruticicola hispida, Linn.

Shell openly umbilicated, suborbiculately depressed, horn-color, shining, with short hairs; spire convex; whorls 5 to 6, rather convex, narrow; aperture broadly lunate; peristome spreading, thickened with white within, its basal terminus more narrow, prominent, and acute. Greater diameter 10, lesser 9 mill.; height, $5\frac{1}{2}$ mill.

Helix hispida, Linnæus, Syst., 675, etc., etc. — Pfeiffer, Mon. Hel. Viv., I. 148.

Hygromia hispida, Tryon, Am. Journ. Conch., II. 308, Pl. V. Fig. 2 (1866).

Fig. 229.



F. hispida.

This is a European species, which has been found at Halifax, Nova Scotia, probably accidentally introduced from England on plants.

Moquin-Tandon figures the jaw of a French specimen as slightly arcuate; ends rounded, somewhat attenuated; anterior surface with numerous ribs, denticulating the concave margin.

For dentition see above. I have not myself had an opportunity of examining the dentition.

The genitalia are figured by Lehmann (Lebenden Schnecken, Pl. XII. Fig.

35). The penis sac is cylindrical, receiving the vas deferens at its summit, the retractor muscle at mid-length; the genital bladder is large, globular, on a long, narrow duct; at its entrance into the vagina there is at each side a group of long, stout cylindrical cæca, the "vesica multifida," and also a dart sac; the sac is double, always consisting of one upper small, and one lower wider, division, making the whole system of sacs quadripartite; in each of these lower divisions is a small, conical dart with apex slightly recurved.

H. plebeium, var. of *hispida*, has been credited to North America by Prestwich, Quart. Journ. Geol. Soc., XXVII. 493.

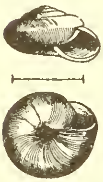
Fruticicola rufescens, PENNANT.

Shell umbilicated, subglobose-depressed, subcarinate, striate, pale reddish; spire moderately elevated; whorls 6, rather convex, the last banded with white, not deflected anteriorly; aperture ovate-lunar; peristome spreading, thickened with white at some distance within, the columellar margin somewhat reflected. Greater diameter 11, lesser 10 mill.; height, 6 mill.

Helix rufescens, PENNANT, etc., etc. — PFEIFFER, Mon. Hel. Viv., I. 141. — W. G. BINNEY, L. & Fr.-W. Sh., I. 159, Fig. 275 (1869).

Hygromia rufescens, TRYON, Am. Journ. Conch., II. 301, Pl. V. Fig. 1 (1866).

Fig. 230.



F. rufescens.

Germany, England, and other European countries. Also found at Quebec, probably introduced from England. It is also said by Tryon (l. c.) to have been found in Canada, Nova Scotia, and Massachusetts, but I have many doubts of its actually having been found at those points.

Jaw as described above (Lehmann, l. c.).

Lingual membrane (Pl. IX. Fig. A) with 26—1—26 teeth. The central teeth have decided side cutting points, but not decided side cusps. These last are developed on the laterals. The change into marginals is gradual, and is not formed by the splitting of the inner cutting point. My figure does not in all respects agree with that of Lehmann, l. c.

Lehmann, in Mal. Blätt., XVI. p. 197, figures the genital system to be as in *hispida* (q. v.).

DORCASIA, GRAY.

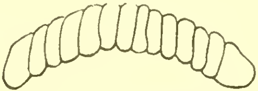
Animal heliciform, as in *Patula*.

Shell moderately umbilicated, globose-conoid or depressed-globose, roughly striate; whorls $4\frac{1}{2}-5$, the last large, globose, more or less deflected anteriorly; aperture lunate-ovate; peristome thickened, reflected, its columellar margin dilated and reflected.

I hesitate to place our two species, *Berlandieriana* and *griseola*, in this genus on account of the geographical range of its species being Australian, Indian, etc. I will, however, temporarily leave them here. I do not believe they properly belong to *Fruticicola.*

I have not examined *D. Berlandieriana.* The other species, *griseola,* has a jaw slightly arcuate, high, ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface entirely covered with numerous, about 12, broad, crowded ribs, denticulating either margin.

Fig 231.



Jaw of *D. griseola.*

Lingual membrane (Pl. VII. Fig. V) long and narrow. Teeth about 27—1—27, with 12 perfect laterals. Centrals with the base of attachment long and rather narrow, the outer lower angles but little expanded, the upper margin broadly reflected; reflection large, with a very stout, long median cusp, bearing a long, stout cutting point extending below the lower edge of the base of attachment; side cusps obsolete, but side cutting points present, large, triangular, acute. Laterals like the centrals, but asymmetrical by the suppression of the inner, lower lateral angle of the base of attachment and inner side cutting point. Marginals low, wide, the reflection broad, equalling the base of attachment and bearing one inner, broad, long, oblique, bifid cutting point, the inner division the smaller, and two outer, smaller, stout, sharp, side cutting points.

Dorcasia Berlandieriana, Moricand.

Vol. III. Pl. XLIX. Fig. 1.

Shell perforated, globose, thin, and translucid, scarcely striated, shining, and with a somewhat silken or opaline lustre, pale yellowish-green, sometimes nearly colorless and generally having a faint, narrow, brownish band around the posterior third of the last whorl; spire consisting of 5 well-rounded whorls, separated by a deeply impressed suture, the last whorl broadly rounded at the periphery; contracted at the aperture, which is small, crescentic, with a white, polished, roundly reflexed peristome, presenting a sharp, inner edge to the interior; the peristome is somewhat angular near its posterior junction, and at this part the shell is thickened within with callus, and is opaque white; base rounded, and perforated by a minute umbilicus. Greater diameter 13, lesser 10 mill.; height, 8 mill.

Helix Berlandieriana, Moricand, Mém. de S. Phys. et d'Hist. Nat. de Genève, VI. 537, Pl. I. Fig. 1 (1833). — Deshayes in Lam. An. sans Vert., VIII. 133; ed. 3, III. 316. — Leidy, T. M. U. S., I. 255, Pl. VIII. Fig. 11 (1851), anat. — Binney, Terr. Moll., II. 109, Pl. XLIX. Fig. 1. — W. G. Binney, Terr. Moll., IV. Pl. LXXVII. Fig. 22; L. & Fr.-W. Sh., I. 159 (1869). — Pfeiffer, Mon. Hel. Viv., III. 227 (not I.); in Chemnitz, ed. 2, II, 275, Pl. CXXIII. Figs. 15-18. — Reeve, Con. Icon., No. 708 (1852). — Fischer and Crosse, Moll. Mex. et Guat., 256 (1870).

Helix pachyloma, MENKE in PFEIFFER, l. c., I. 323; Zeitschr. f. Mal., 1847, IV. 32.

Helix virginalis, PFEIFFER, Mon. Hel. Viv., III. 132; I. 165 as *Berlandieriana*; IV. 140; in CHEMNITZ, ed. 2, I. 260, Pl. XXXVIII. Figs. 18, 19.

Hygromia Berlandieriana, TRYON, Am. Journ. Conch., II. 309 (1867).

A species of the Texan Subregion, found in Arkansas, Texas, and the neighboring portions of Mexico.

Animal quite transparent, yellowish-white, immaculate; eye-peduncles and tentacles darker, with a dark line running back from the former quite under the shell; eyes black.

The genitalia are figured by Leidy (l. c). The genital bladder is stout, oval, on a very short duct; the penis sac is narrow, long, tapering to the apex, where it receives the vas deferens, and one part of the double retractor muscle, the other being attached at about mid-length; near the base of the penis sac is a long cylindrical organ, probably a dart sac.

Lingual membrane as in *griseola*.

Dorcasia griseola, PFR.

Vol. III. Pl. XLIX. Fig. 2.

Shell umbilicated, depressed-globose, obliquely striate, shining, grayish, banded with red, white-margined stripes; spire short; whorls 4 to 4½, rather convex; umbilicus very narrow; aperture lunar; peristome simple, white, reflected somewhat, its columellar end rather expanded. Greater diameter 10, lesser 8⅔ mill.; height, 6 mill.

Helix griseola, PFEIFFER, Symb. Hist. Hel., I. 41; Mon. Hel. Viv., I. 337; in CHEMNITZ, ed. 2, I. 342, Pl. LX. Figs. 17, 18. — REEVE, Con. Icon., No. 327 (1852). — W. G. BINNEY, Terr. Moll., IV. 50, Pl. LXXVII. Fig. 20; L. & Fr.-W. Sh., I. 160 (1869). — FISCHER and CROSSE, Moll. Mex. et Guat., 257 (1870).

Helix cicercula, FÉRUSSAC in Mus., teste PFEIFFER.

Helix splendidula, ANTON, Verz., 36, no descr., teste PFEIFFER.

Helix albocincta, BINNEY, Terr. Moll., I. 128.

Helix albozonata, BINNEY in Tab., XLIX. Fig. 2.

Helix Berlandieriana, GOULD, part, in Terr. Moll., II. 109.

Helix albolineata, GOULD, Terr. Moll., III. 34.

Hygromia griseola, TRYON, Am. Journ. Conch., II. 309 (1867).

A species of the Texan Subprovince, found at Indianola, and in Bosque County, Texas. In Mexico its range is wide, extending, indeed, into Guatemala and Nicaragua.

Jaw with about 10 broad, crowded ribs, denticulating the cutting margin; upper margin with membranous attachment. The jaw is somewhat of the type figured by Moquin-Tandon for that of *Helix hispida* (see p. 347).

Lingual membrane (see p. 347).

Genitalia unknown.

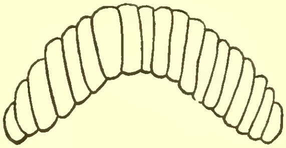
TURRICULA, Beck.

Animal heliciform, mantle subcentral; other characters as in *Patula*.

Shell umbilicated or perforated, conical; often obliquely costulate, banded with chalky-white or of a uniform tawny color; whorls 5 – 10, rather flattened, sometimes turreted, more or less angular or carinated; aperture lunate, narrow, peristome straight, its extremities thickened within.

Jaw described with from 8 to 10 ribs. That of several French species is figured by Moquin-Tandon. *T. terrestris* has over 18 broad, flat, crowded ribs, slightly denticulating either margin; the jaw is low, wide, slightly arcuate, ends but little acuminated, blunt.

Fig. 232.



Jaw of *T. terrestris.*

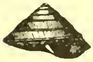
Lingual membrane (of *T. terrestris*, from Charleston, South Carolina) with 20—1—20 teeth, the ninth tooth having its inner cutting point bifid, centrals tricuspid, laterals bicuspid, marginals low, wide, with one inner, long, oblique, bluntly bifid cutting point, and one outer, smaller, sharply bifid (see Pl. XV. Fig. M).

A genus of the circa-Mediterranean fauna, one species of which, *T. terrestris*, has been introduced by commerce within our limits.

Turricula terrestris, Chemnitz.

Shell umbilicated, conic-roof shaped, white, above with delicate striæ, and hardly unifasciate, flattened below; whorls 6, flat, somewhat turreted, narrowly carinated; umbilicus very narrow, pervious; aperture axe-shaped; peristome straight, acute, within thickened with white. Greater diameter 10, lesser 9 mill.; height, 6½ mill.

Fig. 233.



T. terrestris, enlarged.

Trochus terrestris, Chemnitz.
Helix terrestris, Pfeiffer, Mon., I. 179.

Found in Italy, Sicily, and South of France. I have lately received living specimens collected by Mr. W. G. Mazyck in St. Peter's Churchyard, Charleston, South Carolina, no doubt imported on plants. These specimens resemble Moquin-Tandon's (Pl. XX. Figs. 10, 11).

Jaw arcuate, ends blunt, but little attenuated; anterior surface with 18 stout, crowded, flat ribs. (See Fig. 232.)

Lingual membrane (see above).

Genital system, as figured by Moquin-Tandon, has a penis sac short, stout, with a very long flagellate extension, on the middle of which enters the vas deferens; the retractor muscle is inserted at the commencement of the flagellum; the genital bladder is small, suboval, with a duct three times its length and very stout; at the entrance of this duct into the vagina there are, on both sides, a bundle of (four) multifid vesicles; quite near the common orifice there is a small, globular sac, enclosing in place of the usual dart a small body fringed or digitated by four or five unequal obtuse lobes.

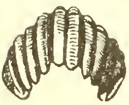
AGLAIA, ALBERS.

Animal heliciform, as in *Patula;* mantle subcentral.

Shell umbilicate, orbicularly convex, striatulate, banded; whorls 4½ – 6, the last deeply deflexed in front; aperture lunate-ovate, very oblique; peristome thickened, expansively reflexed, white, its margins approaching, that of the columellar dilated, reflexed, free, partially covering the umbilicus.

Within our limits this genus is found only in the Pacific Region. A few Mexican and South American species are also known.

Fig. 234.



Jaw of *A. infumata.*

Jaw thick, high, arched, ends but little attenuated, blunt; cutting edge without median projection; anterior surface with stout, separated ribs, denticulating either margin, from 5 to 9 in *A. infumata* (Fig. 234), about 6 in *fidelis.* The other American species, *H. Hillebrandi*, I have not examined.

Lingual membrane long and narrow. That of *Hillebrandi* not examined, those of *infumata* and *fidelis* agreeing in their general characters. The centrals have a base of attachment longer than wide, with incurved lower margin and expanded lower lateral angles; upper margin broadly reflected; reflection short, stout, with no side cusps or cutting points, but a very stout, short median cusp, bearing a short cutting point. Laterals like the centrals, but asymmetrical by the base of attachment wanting the inner, lower lateral expansion; it is, however, unusually developed on its inner side margin: first marginals differing from the laterals by the equalling of the reflection and base of attachment, the lesser development of the cusp, and greater development of the cutting point, which is bluntly bifid, the inner division the smaller. On some of the first marginals of *infumata* there is a small side cutting point. Marginals low, wide, the reflection equalling the base of attachment, and bearing one long, oblique, wide, bifid cutting point, the inner division the smaller, and one or two short, sharp, side cutting points. There is great variation in the cutting points.

A comparison of the two figures will show a longer base of attachment in *fidelis*, with a line of reinforcement or duplication to its upper margin. As with all species, there is much variation in the length of the cutting point, in centrals and laterals, and their arrangement and development in the marginals.

Of the dentition of the other species of *Aglaia* foreign to our limits but little is known. *A. Ghiesbreghti* (see Moll. Mex. et Guat.) has very dissimilar teeth, especially the marginals. *A. semiclausa* (Malk. Blätt. XV. Pl. IV. Fig. 4) also differs in its dentition. The jaws of these species agree with those of *infumata* and *fidelis.*

Aglaia fidelis, GRAY.

Vol. III. Pl. XII.

Shell umbilicated, orbicularly subconoid; epidermis light-yellow or brownish on the upper surface, with a black or chestnut-colored revolving band visible on the four outer whorls, the lower surface dark chestnut, sometimes uniformly black; suture distinct, impressed; whorls 7, rounded, spirally striate, with minute, delicate, impressed lines, the striæ of increase very distinct; peristome reflected below, simple above, thickened; aperture ovate, banded within; umbilicus open, a little contracted by the reflection of the peristome; base flattened-convex. Greater diameter 34, lesser 30 mill.; height, 20 mill.

Helix fidelis, GRAY, Proc. Zoöl. Soc., July, 1834, 67. — PFEIFFER, Mon. Hel, Viv., I. 338; in CHEMNITZ, ed. 2, I. 321, Pl. LVII. Figs. 12, 13. — MÜLLER, Syn. Test., anno 1834 promulg., 8 (1836). — REEVE, Con. Icon., No. 657 (1852). — W. G. BINNEY, Pac. R. R. Rep., VI. 111 (1857); Terr. Moll., IV. 14; L. & Fr.-W. Sh., I. 161 (1869).

Helix Nuttalliana, LEA, Am. Phil. Trans., VI. 88, Pl. XXIII. Fig. 74; Obs., II. 88 (1839); TROSCHEL, Arch. f. Nat., 1839, II. 229. — BINNEY, Bost. Journ. Nat. Hist., III. 369, Pl. XII. (1840); Terr. Moll., II. 159, Pl. XVIII. — DEKAY, N. Y. Moll., 46 (1843). — GOULD, U. S. Expl. Exped. Moll., 66, Fig. 38 (1852).

Aglaja fidelis, TRYON, Am. Journ. Conch., II. 311, 8 (1866).

A species of the Oregonian Region, found from Humboldt Bay, California, to Vancouver's Island, and westward to the Cascade Mountains From Mt. Shasta the specimens are half as large as usual.

Animal: color dull ochre, slaty towards the tail; coarsely granular upon the neck, but from a line running from the dorsal line, where it issues from the shell, to the mouth, the granules diminish, and are succeeded by coarse, undulating, interrupted ridges, radiating in every direction from the aperture, and terminating in a line nearly marginal; edge simple.

This species varies in coloring. The form figured has its upper surface dirty white, with oblique, longitudinal, dark blotches and a revolving dark band, below uniformly dark chestnut. Another form is like this, excepting that the dirty white is replaced with light chestnut or with dark chestnut. There are also forms where the dark chestnut prevails over the whole shell, the band being sometimes obsolete, and where the chestnut is sometimes replaced by uniform black. The upper surface is, however, usually lighter than the lower; the band when present is usually edged with white. The peristome is always light-colored. The uniform dark form can hardly be distinguished from *A. infumata*, sharing also the peculiar sculpturing of that species. Indeed, there are grave reasons for suspecting that *fidelis* and *infumata* will prove one and the same species.

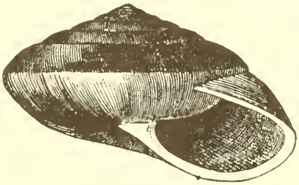
Jaw (see above).

The lingual membrane (Pl. IX. Fig. C) has 48—1—48 teeth, with 15 laterals, the sixteenth tooth having a split inner cutting point. The first marginal is shown as also an outer marginal.

The genitalia of *fidelis* and *infumata* are almost exactly similar. In both the penis sac is extended into a decided flagellum. The vas deferens enters below the flagellate extension. The retractor muscle is attached on the opposite side and still lower down. There is a well-marked prepuce. Opposite the entrance of the penis, on the other side of the vagina, which is here considerably swollen, is a sac-like organ (Pl. XV. Fig. E, *pr. g*), ending in a smoothly rounded dart sac (*d s*), with a short dart within it. Just below this dart sac opens the duct of another very variable organ (*a g*), cylindrical, hollow, of a reticulated appearance, irregular in size and bearing a globular apex; it is much longer than the penis with its flagellum, and stouter, as in Fig. E, or much less developed, and without the bulb as in F. No dart was noticed within this organ. It is, no doubt, a form of vaginal prostate, as described by Moquin-Tandon. The genital bladder is globular. Its duct is long, free in the upper half of its course. The oviduct, ovary, genital bladder, testicle, etc., of *infumata* (Fig. F) are not figured by me. They are as in *fidelis* (Fig. E). This comparison of the genitalia strengthens the belief of the identity of the two forms.

Aglaia infumata, Gould.

Fig. 235.



A. infumata.

Shell umbilicated, large, discoidal, biconvex, obtusely carinated at the periphery, widely umbilicated, smoky above, roughened with minute, oblique, rasp-like irregularities which bear very short, soft hairs in the fresh state, below very black, shining and minutely granulated; whorls $6\frac{1}{2}$, convex; aperture rhomboidal; peristome reddish, somewhat reflected at base; throat silky-lilac, near the peristome smoky. Diameter, 37 mill.; height, 20 mill.

Helix infumata, Gould, Proc. Bost. Soc., V. 127 (1855); Terr. Moll., III. 13. — W. G. Binney, Pac. R. R. Rep., VI. 112 (1857); Terr. Moll., IV. 15, Pl. LXXIX. Fig. 2; L. & Fr.-W. Sh., I. 161 (1869). — Pfeiffer, Mon. Hel. Viv., IV. 351.

Aglaja infumata, Tryon, Am. Journ. Conch., II. 310 (1867).

Californian Region from Humboldt's Bay to San Pablo Bay, especially in Marin, Alameda, Mendocino Counties.

The species has a thick, white, membranous epiphragm. I have already (p. 351) expressed my belief of its being identical with *fidelis*.

Jaw very arcuate, of uniform width throughout; ends square; anterior surface with 5 – 9 crowded, stout ribs, denticulating either margin.

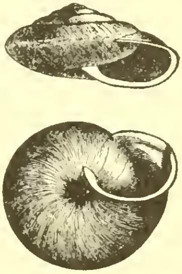
Lingual membrane (Pl. IX. Fig. B) has 45—1—45 teeth, with 16 laterals, the seventeenth tooth having its inner cutting point bifid. There are no side cusps or cutting points on centrals and first laterals.

Genitalia (see above).

Aglaia Hillebrandi, Newcomb.

Shell umbilicated, biconvex, orbicularly depressed, carinated; yellowish horn-color, with a chestnut band within two white ones, showing only in the aperture, granulated, finely striate and hirsute; spire subpyramidal; whorls 6, slightly convex, the last carinated at its middle, inflated below, slightly descending; aperture oblique, lunate, subangulate, white and banded within; peristome white, thickened, reflected, partially concealing the open umbilicus, ends approached. Greater diameter 25, lesser 19 mill.; height, 10 mill.

Fig. 236.



A. Hillebrandi.

Helix Hillebrandi, Newcomb, Proc. Cal. Acad. Nat. Sci., III. 115, 181 (1864). — W. G. Binney, L. & Fr.-W. Sh., I. 163, Fig. 281 (1869).

Aglaja Hillebrandi, Tryon, Am. Journ. Conch., II. 310, Pl. V. Fig. 7 (1866).

Tulumne County, California Region; also near Mariposa. The specimen figured is from Dr. Newcomb.

Animal unobserved.

ARIONTA, Leach.

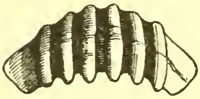
Animal heliciform, mantle subcentral; other characters as in *Patula*. Provided with a thick, white epiphragm.

Shell umbilicately perforate, conic- or depressed-globose, thin; whorls 5 – 6, the last gradually descending; aperture lunate-rotund; peristome broadly labiate, its margins parallel, the basal dilated, often covering the umbilicus.

The genus is almost exclusively confined to the California Region of our limits. There is, however, one Mexican species, one African, and one European, *A. arbustorum*. The jaw of the last agrees with that of our species.

Jaw thick, high, arched, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with a few, separated, stout ribs, deeply denticulating either margin, and so disposed as to leave each end of the jaw free from ribs. I have counted 6 ribs on the jaw of *arrosa;* 9 in *Townsendiana;* 6 in *tudiculata;* 4 in *Dupetuhouarsi;* 6 in *Nickliniana;* 6 in *redimita;* 6 in *exarata;* 5 in *Diabloensis;* about 7 in *Carpenteri;* 3 in *ramentosa;* 5 in *Ayresiana;* 5 in *Californiensis;* 4 – 6 in *sequoicola;* 8 in *Traski;* 8 in *facta;* 6 in *Kelletti;* 7 in *Carpenteri;* 9 of unequal size in *Stearnsiana*. The jaw of *ruficincta* differs in having over 10 ribs covering its whole surface, and in being only slightly arcuate.

Fig. 237.



Jaw of *A. arrosa*.

I have not examined *intercisa*.

The lingual membrane is long and narrow, arranged as in *Patula*. The characters of the individual teeth are shown in my plates. In Fig. O, P, R, S, and U, the gradual change from central through laterals to the extreme marginals is shown. The central teeth have a base of attachment much longer than wide, with incurved lower margin and expanded lower lateral angles; the upper margin broadly reflected; reflection short, stout, with subobsolete side cusps bearing no cutting points, and a stout, long median cusp bearing a short, blunt cutting point, which does not reach the lower margin of the base of attachment; the reflection with the median cusp is pear-shaped; in many species there is a duplicate line of reinforcement parallel to the upper margin of the base of attachment. The lateral teeth are of similar type to the centrals, but are asymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment. The outer laterals have a side cusp and cutting point. The transition from laterals to marginals is formed by the greater proportional development of the cutting point, the lesser development of the cusp; the cutting point then becomes bifid, the reflection becomes more nearly the same size as the base of attachment, and thus the true marginals are gradually reached. These last are longer than wide, have a base of attachment smaller than the reflection and cut away on its lower inner angle; the reflection is produced into one long, sharp, oblique, bifid cutting point, the inner division the smaller, and one outer, much shorter, sharp, rarely bifid cutting point.

Most of the species examined agree in dentition with *Stearnsiana*. Some have more blunt cutting points to their marginals, as *sequoicola* (Pl. IX. Fig. J), but even on various parts of the same membrane the marginals vary in this respect. In *Kelletti*, *Stearnsiana*, *tudiculata*, *arrosa*, *Traski*, *sequoicola*, *Ayresiana*, *redimita*, *Nickliniana*, *ramentosa*, *exarata*, *Diabloensis*, *facta*, *Carpenteri*, I have failed to detect any side cutting points to the central and inner lateral teeth. I found the points, however, in *A. ruficincta* (Pl. IX. Fig. N). *A. Townsendiana* (Pl. IX. Fig. Q) has these cutting points and side cusps on central and all the lateral teeth; its centrals and laterals are not of the same shape as described above, but resemble those of *Polygyra*, *Stenotrema*, and *Triodopsis*. Thus in this as in other genera we find the type of dentition not constant in all the species.

The long, narrow base of attachment and pyriform reflection of most of the species of *Arionta* agree with those of *Hemitrochus* more nearly than any other of our genera, but that genus has quite different marginal teeth.

The dentition of *A. arbustorum* is alone known of the species foreign to America, and that by a figure of Lehmann (Lebenden Schnecken, Pl. XI. Fig. 29) too unsatisfactory to be of value for the purpose of comparison.

Arionta arrosa, GOULD.

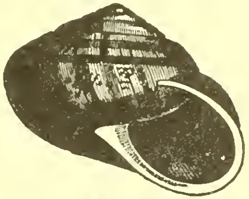
Shell globose-conic, thick, umbilicated, indented, and minutely granulated; color reddish-olive, varied with yellow, and with a fuscous revolving band; whorls 7, convex; aperture roundly ovate; peristome reflected, flesh-colored; throat bluish. Diameter, 40 mill.; height, 18 mill.

Helix æruginosa, GOULD, Proc. Bost. Soc., V. 127 (1855); Terr. Moll., III. 12. — W. G. BINNEY, Pac. R. R. Rep., VI. 113 (1857); preoc. in *Helix*.

Helix arrosa, GOULD, in litt.; Otia, 215. — W. G. BINNEY, Proc. Acad. Nat. Sci. Philad., 1857, 185; Terr. Moll., IV. 15, Pl. LXXVI. Fig. 4; L. & Fr.-W. Sh., I. 163 (1869). — PFEIFFER, Mon. Hel. Viv., IV. 350.

Aglaja arrosa, TRYON, Am. Journ. Conch., II. 311 (1867).

Fig. 238.



A. arrosa.

In the Californian Region, Santa Cruz to Mendocino County, two hundred miles along the coast, only twenty-five miles inland. (Cooper.)

I have in my cabinet an albino form, and specimens very much smaller than that figured.

The epiphragm is white, thick, membranous.

Jaw arcuate, of uniform breadth throughout; ends blunt; anterior surface with a few (6) rather distant, stout ribs crenulating both margins (see Fig. 237).

The lingual membrane (Pl. IX. Fig. D) has 54—1—54 teeth, 17 laterals, 180 rows. Teeth of the type usual in the genus.

The genitalia (Pl. XIII. Fig. I) are as in *A. Nickliniana*. The penis sac is extremely long and gradually tapers into a flagellum. It receives the retractor muscle beyond the middle of its length, and the vas deferens at three quarters of its length from the vagina. The genital bladder is very small, oval, on a very long duct, which has a very long, stouter accessory duct (*a d*). The vaginal prostate with its bifurcate flagellum was not present in an individual whose genital system was formerly described and figured by me. I have recently observed it in numerous specimens, and it is figured by Semper (Phil. Arch., Pl. XV. Fig. 13). *d s* is a dart sac. The dart is short, stout, acuminated, on a broad flat base.

Arionta Townsendiana, LEA.

Vol. III. Pl. XIX.

Shell umbilicated, depressed-globose; epidermis yellowish and brownish horn-color, more or less intermixed; suture distinct; whorls 5½, with minute, impressed, longitudinal striæ, which can scarcely be traced by the eye, and coarse, oblique wrinkles and striæ; body-whorl large, voluminous, rough, and corrugated; aperture rather large, somewhat rounded; peristome white, fully reflected at the base, and but partially so towards its superior part, thickened, and a little projecting internally in the base of the aperture; umbilicus open, deep, a little contracted by the reflection of the peristome; base convex and turgid. Greater diameter 29, lesser 24 mill.; height, 16 mill.

Helix Townsendiana, LEA, Trans. Am. Phil. Soc., VI. 99, Pl. XXIII. Fig. 80 (1840); Obs., II. 99 (1839); in TROSCHEL'S Arch. f. Nat., 1839, II. 221. — BINNEY, Bost. Journ. Nat. Hist., III. 371, Pl. XIII.; Terr. Moll., II. 161, Pl. XIX. — DEKAY, N. Y. Moll., 46 (1843). — PFEIFFER, Mon. Hel. Viv., I. 341; in CHEMNITZ, ed. 2, I. 323, Pl. LVII. Figs. 10, 11 (1846). — REEVE, Con. Icon., 625 (1852). — GOULD, U. S. Expl. Exp. Moll., 66, Fig. 36 (1852). — W. G. BINNEY, Terr. Moll., IV. 15; L. & Fr.-W. Sh., I. 164 (1869). — BLAND, Ann. N. Y. Lyc., VII. 362.

Mesodon Townsendiana, TRYON, Am. Journ. Conch., III. 46, Pl. VIII. Fig. 8, var. Fig. 6.

Helix pedestris, GOULD formerly. See Otia, 243.

Helix ruida, GOULD formerly.

Helix ptychophora, A. D. BROWN, Journ. de Conch., 3d series, X. 392, Oct., 1876.

A species of the Oregonian Region, traced thus far from Crescent City, California, to the Straits of de Fuca; it also passes the Cascade Mountains, into the Interior Province, and along the mountains extends southeasterly into Idaho and Montana.[1]

Animal corpulent, gradually tapering. Color pale yellowish-green; surface with rather sparse, feebly developed, elliptical granules, not seeming to have any regular arrangement. Margin of disk rather broad, granulated, but regularly marked with radiating furrows.

A small variety (17 mill. diameter) is found, more strongly and coarsely wrinkled, called *H. ptychophora* (see above).

This is the most abundant species, especially along the coast, where, unlike most of our American forest snails, it frequents open prairies among the fern. It is particularly abundant on low sandy bars just above high tide, which are covered with a deep, rich deposit of shell marl, and have been formerly favorite camping-grounds of the Indians. These places, being very productive, are much cultivated by the whites; and immense numbers of this animal's shells are found when the grass and bushes are first burnt off. They continue to live in potato fields in the same places. The bare face of Cape Disappointment, fronting the ocean, is also a locality. I did not find this species about Puget Sound. (Dr. J. G. Cooper, P. R. R. Rep., p. 376.)

Jaw as usual; 9 ribs.

The lingual membrane (Pl. IX. Fig. Q) has 60—1—60 teeth. Another membrane had 40—1—40 teeth. The variety *ptychophora* (Pl. XV. Fig. N) has similar dentition.

It is peculiar in having decided side cutting points to central and lateral teeth, and side cusps to the laterals.

The genitalia are figured (Pl. XIV. Fig. A). The accessory gland of the epididymis is composed of several acini of different sizes. The genital bladder is lengthened, oval, having a very short, stout duct. At the opening of the penis sac there is a decided enlargement, perhaps of the nature of a prepuce, or prostate. The vas deferens enters the penis sac below its apex. The retractor muscle is at the apex of the penis sac. There seems no accessory organ, the genitalia being reduced to their simplest type, and thus widely differing from the allied species.

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[1] Recently found also in Umatilla County, Oregon.

Arionta tudiculata, Binney.

Vol. III. Pl. XVI.

Shell subumbilicated, orbiculate-convex; epidermis olivaceous; spire a depressed cone; whorls between 5 and 6, slightly convex; body-whorl voluminous, expanding somewhat towards the aperture; aperture transverse, rather circular; peristome whitish, thin, expanded, slightly reflected at the basal portion, at the columella dilated, reflected, and almost closing the umbilicus; base convex; a well-defined, rather wide, dark chestnut band, margined with a light color above and below, revolves near the centre of the body-whorl, and is more or less visible above the suture on the two whorls preceding the last; surface of the outer whorl covered with somewhat regular impressions or indentations with ridges between, causing it to look as if covered with scales; when these are not apparent, it is marked with oblique wrinkles. Greater diameter 33, lesser 26 mill.; height, 19 mill.

Helix tudiculata, Binney, Bost. Journ. Nat. Hist., IV. 360, Pl. XX. (1843); Terr. Moll., II. 118, Pl. XVI. — Pfeiffer, Mon. Hel. Viv., I. 283; IV. 270. — W. G. Binney, Terr. Moll., IV. 7; L. & Fr.-W. Sh., I. 165 (1869).

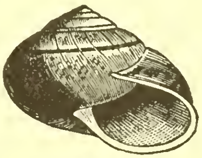
Aglaja tudiculata, Tryon, Amer. Journ. Conch., II. 313 (1867).

A species of the California Region, traced from Washington Territory to San Diego, and even to Todos Santos Bay in Lower California.

I have lately received this species under the name of "*H. cypreophila*, Newc., Copperopolis, Cal.," from Dr. Newcomb, one of whose specimens is here figured.

Jaw thick, long, narrow, slightly arched; ends but slightly attenuated, blunt; anterior and posterior surface equally showing 6 stout, broad ribs, denticulating either margin.

Fig. 239.



H. cypreophila.

The lingual membrane (Pl. IX. Fig. E), has 50—1—50 teeth, with 26 perfect laterals; all of the type usual in the genus. The dentition and genitalia of *cypreophila* is similar to those of the typical form.

Genitalia as in *A. Nickliniana.*

Arionta Nickliniana, Lea.

Vol. III. Pl. VI. a.

Shell subumbilicated, conic-globose, rather thin, the surface lightly marked by the lines of growth, faintly indented and delicately shagreened with fine microscopic granules arranged in quincunx; pale horn-color or sometimes cinereous, girdled with a single narrow chestnut bronze zone, paler at its edges; the whole covered with a thin, yellowish-brown epidermis; spire elevated, whorls 6, moderately convex, the outer one ventricose, with some approach to an angular periphery; base tumid, depressed at centre, and perforated by a very small umbilicus; aperture rounded, forming two thirds of a circle, banded within; peristome white, slightly reflected above, more so below, until at the umbilicus it is quite revolute, and mostly covers the opening. Greater diameter 28, lesser 23 mill.; height, 19 mill.

Helix Nickliniana, LEA, Trans. Am. Phil. Soc., VI. 100, Pl. XXIII. Fig. 84; Obs., II. 100 (1839); TROSCHEL, Arch. f. Nat., 1839, II. 221. — BINNEY (part), Terr. Moll., II. 119, Pl. VI. a. — W. G. BINNEY, Terr. Moll., IV. 7; L. & Fr.-W. Sh., I. — PFEIFFER, Mon. Hel. Viv., IV. 269.

Helix Californiensis, PFEIFFER, Mon. Hel. Viv., I. 339; III. 229; in CHEMNITZ, ed. 2, 332, Pl. LVII. Figs. 14, 15, excl. var. 2 (1846). — REEVE, Con. Icon., No. 661. — Not of LEA.

Helix arboretorum, VALENCIENNES, Voy. de la Venus, Moll., Pl. I. Fig. 3 (see Terr. Moll., IV. Pl. LXXVI. Fig. 13).

Helix nemorivaga, VALENCIENNES, l. c. Fig. 1 (see Terr. Moll., Vol. IV. Pl. LXXIX. Fig. 11).

Helix anachoreta, W. G. BINNEY, Proc. Acad. Nat. Sci. Philad., 1857, 185; Terr. Moll., IV. 11, Pl. LXXVI. Fig. 5. — PFEIFFER, Mon. Hel. Viv., IV. 349.

Aglaja Nickliniana, TRYON, Am. Journ. Conch., II. 312 (1867).

Aglaja anachoreta, TRYON, Am. Journ. Conch., II. 311 (1867).

California Region, from Santa Cruz to Mendocino County. (Cooper.)

The animal has a uniform dark lead-color over the body, darker on head and eye-peduncles; base of foot dirty white. Tail almost carinated, pointed.

The epiphragm is as usual in the genus.

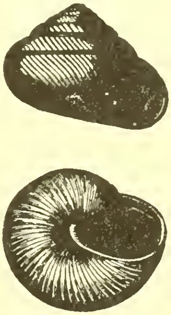
Jaw as usual in the genus; over 6 ribs.

Lingual membrane (Pl. IX. Fig. F) as usual; teeth 44—1—44, with 16 laterals, the seventeenth tooth having its inner cutting point bifid.

The genitalia are figured on Pl. XIII. Fig. C. The ovary is yellow, long, narrow, concave on one side, convex and carinated on the other. The accessory gland of the epididymis is composed of long white cæca. The oviduct is extremely long, narrow, convoluted. The genital bladder is globular, small, with an extremely long duct, to which is added an accessory duct or branch, almost as long as the oviduct. This branch joins the duct near its end. It is thicker than the duct. The duct enters the vagina at its upper part. The penis sac is long, cylindrical, small, almost equalling in length the oviduct and ovary united. The retractor muscle is inserted at about the middle of its length, it is attached to the diaphragm; the vas deferens enters about three fourths of its length; beyond the vas deferens is a flagellate extension. The vagina is long and narrow; near its base, opposite the entrance of the sac of the penis is a stout, cylindrical, long, hollow, vaginal prostate, gradually tapering at its apex, and extended into a delicate tube, which soon becomes divided into two long flagella. Just beyond the division, on each flagellum, is a stout bulb-like enlargement.

Arionta Ayersiana, Newcomb.

Fig. 240.



A. Ayersiana.

Shell umbilicated, globosely convex, rather thick, of a dead white with a narrow revolving brownish band, with rough oblique incremental striæ deeply cut by coarse revolving lines; whorls 7, rather convex, the last globose, descending in front; spire elevated; umbilicus small; aperture oblique, subcircular, banded within; peristome simple, its ends joined by a light callus, that of the columella widened, reflected over and half concealing the umbilicus. Greater diameter 21, lesser 19 mill.; height, 12½ mill.

Helix Ayersiana, Newcomb, Proc. Cal. Acad. Nat. Sci., II. 103 (1861). — W. G. Binney, L. & Fr.-W. Sh., I. 72, Fig. 120 (1869).

Aglaja Ayersiana, Tryon, Am. Journ. Conch., II. 312 (1866), III. (1867).

Santa Cruz Island; San Miguel Island; Santa Rosa Island in the California Region; not in Oregon, as erroneously stated.

Animal long and slender, smoky white, covered with white coarse granulations running longitudinally down the back, one line of granulations very prominent and central, bordered on either side with a deep furrow. Also oblique lines of granulations running down the sides of the foot. Foot dirty white below. Tail short, broad, pointed. Some individuals are darker, with a purplish tinge.

The usual color of the shell is a light chestnut, but from San Miguel Island I have a large individual (30 mill.) of a very dark hue. The shell is sometimes bandless.

The epiphragm is white, thick, membranous.

My description and figure are drawn from an authentic specimen.

Jaw as usual; 5 ribs.

The lingual membrane (Pl. IX. Fig. H) has 50—1—50 teeth, with 15 perfect laterals. The outer laterals have a long inner cutting point, but no side cutting point.

Genitalia as in *A. Traski*. The flagellate extensions of the vaginal prostate beyond the bulbs in this species are, however, much shorter and stouter.

Arionta redimita, W. G. Binn.

Vol. III. Pl. VI. Fig. 1, except middle fig.

Shell imperforate, globose-conic, rather thin, wrinkled, covered with minute and crowded granulations; color reddish-brown; apex free from granules, rather blunt; spire elevated; suture impressed; whorls 6, convex, the last quite large and rounded, falling towards the aperture, and banded with reddish-brown above the middle; aperture rather large in proportion to the size of the shell, very oblique, transversely rounded, within showing the band; peristome simple, reddish ash-color, thickened, reflected slightly at the base, ends approached; umbilicus entirely covered with a white callus. Greater diameter 31, lesser 17 mill.; height, 12 mill.

Helix redimita, W. G. BINNEY, Proc. Acad. Nat. Sci. Philad., 1857, 183; Terr. Moll., IV. 10; L. & Fr.-W. Sh., I. 167 (1869). — PFEIFFER, Mon. Hel. Viv., IV. 349.

Helix Nickliniana, var., BINNEY, Terr. Moll., III. Pl. VI. Fig. 1 (except middle figure).

Polymita redemita, TRYON, Am. Journ. Conch., II. 320 (1867).

San Clemente Island, California, in the California Region.

This will probably prove a less developed form of the protean *ramentosa*. I retain it therefore with great doubt as a distinct species.

Jaw stout, strongly arched, transversely striate in parts; ends blunt, scarcely attenuated; with 6 prominent, sharp ribs, equally visible on both anterior and posterior surface, their ends strongly pectinating both margins.

The lingual membrane (Pl. IX. Fig. G) has 43—1—43 teeth. The seventeenth tooth has its inner cutting point split. I can detect no side cusps to outer laterals.

Genitalia unobserved.

Arionta intercisa, W. G. BINN.

Vol. III. Pl. VI. Fig. 1, middle fig.

Shell globose-conic, with 5 slightly rounded whorls; spire little elevated; suture distinct; upon the body-whorl a dark revolving band, hardly discernible; aperture very oblique, shape of a horseshoe; peristome thickened, heavy, dirty white, slightly reflected at the umbilicus, which it entirely conceals, near its junction with the columella furnished with a tooth-like process, the extremities connected by a heavy ash-colored callus, which is spread more lightly over the whole parietal wall; epidermis grayish-yellow, apex rufous; the striæ of growth are very numerous and distinct, crossed by numerous, regular, revolving lines, so deeply impressed as to entirely separate them into small sections; thus the whole surface of the shell is divided into minute, raised parallelograms, separated by the deep longitudinal and horizontal furrows. Greatest diameter 22, lesser 19 mill.; height, 15 mill.

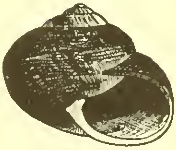
Helix intercisa, W. G. BINNEY, Proc. Acad. Nat. Sci. Philad., 1857, 18; Proc. Bost. Soc. Nat. Hist., VI. 156 (1857); Terr. Moll., IV. 8; L. & Fr.-W. Sh., I. 167 (1869). — PFEIFFER, Mon. Hel. Viv., IV. 349.

Helix Nickliniana, var., BINNEY, Terr. Moll., II. 120; III. Pl. VI. Fig. 1 (middle figure).

Helix crebristriata, Newcomb, Proc. Cal. Acad. Nat. Sci., III. 116.
Polymita intercisa, Tryon, Am. Journ. Conch., II. 319 (1867).
Arionta crebristriata, Tryon, l. c., II. 317 (1867).

This species of the California Region, until quite recently known only by the single specimen in Dr. Binney's collection, supposed to be from Oregon, has recently been described from San Clemente Island, and Santa Cruz Island, California, under the name of *H. crebristriata*, by Newcomb, one of whose specimens is here figured. An apparently semi-fossil form occurs, with thick shell, heavy, rough growth beyond the peristome, which is made continuous by its ends being joined by a very solid, raised callus.

Fig. 241.



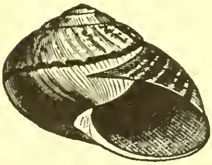
A. crebristriata.

Animal unobserved.

Arionta Kelletti, Forbes.

Shell narrowly umbilicated, depressed-globose, thin, wrinkled, granulated, fulvous; spire subturbinated, with dirty reddish blotches and one red revolving band; whorls 6, rather convex, the last with a white band at its periphery, and inflated on its under surface; aperture roundly lunate, light red and banded within; peristome somewhat reflected, its columellar portion dilated, reflected, covering the umbilicus. Greater diameter 22, lesser 19 mill.; height, 19 mill. (Forbes.)

Fig. 242.



A. Kelletti.

Helix Kelletti, Forbes, Proc. Zoöl. Soc. London, 1850, 55, Pl. IX. Fig. 2, a, b. — Reeve, Con. Icon., No. 665 (1852). — Pfeiffer, Mon. Hel. Viv., III. 183; in Chemnitz, ed. 2, II. 467, Pl. CLVI. Figs. 19, 20 (1853). — W. G. Binney, Terr. Moll., IV. 17, Pl. LXXXVI. Fig. 12; L. & Fr.-W. Sh., I. 176, Fig. 309 (1869).
Arionta Kelletti, Tryon, Am. Journ. Conch., II. 317 (1866).

San Diego; Catalina Island, San Nicolas Island? California; in the California Region.

Animal bluish slate-color.

The specimen figured is from Catalina Island, California. I am positive that it is correctly referred to *Kelletti*. The umbilicus is entirely closed in mature specimens. There are traces on different parts of each shell of three different series of sculpturing; the wrinkles of growth, revolving impressed lines, and a series of minute granulations running obliquely, sometimes almost perpendicularly, to the incremental wrinkles.

Forbes's original figure of *H. Kelletti* is copied in Volume IV.

For comparison with *A. Stearnsiana*, see that species.

Jaw as usual; 6 ribs.

The lingual membrane (Pl. IX. Fig. I) has 57—1—57 teeth; the sixteenth has a side cutting point; the twentieth tooth has its inner cutting point split; the outer cutting point of the marginals is very rarely bifid.

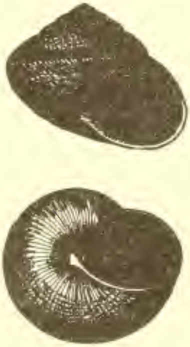
The genitalia of a Catalina Island specimen is figured (Pl. XIII. Fig. D).

The ovary is light yellow. The oviduct is white. The genital bladder is light yellow. The prostate is large and yellow. The whole genital system is long and narrow. The genital bladder is small, globular, on an extremely long and delicate duct which enters the vagina at its upper end. The duct just below the bladder receives a branch duct, very long, flagellate, three times the diameter of the duct itself. The penis sac is long, stout, cylindrical, tapering towards its apex and prolonged into a very long delicate flagellum. The vas deferens enters at the point where the flagellum commences. The retractor muscle is inserted half-way between the vagina and the entrance of the vas deferens. Opposite the mouth of the penis sac is a small sac-like organ, probably a dart sac or vaginal prostate.

As stated below, this arrangement of the genitalia differs somewhat from that of *Stearnsiana*.

Arionta Stearnsiana, Gabb.

Fig. 248.



A. Stearnsiana.

Shell narrowly umbilicated, subglobose, solid, of a dirty white color, irregularly mottled with crowded ashy blotches, grouped into revolving series below, with a decided wide, brownish revolving band above; with delicate oblique incremental striæ, unequally cut by revolving lines; spire elevated; whorls 5, rather convex; aperture oblique, semicircular; peristome simple, acute, its columellar termination white, expanded, reflected over the half-concealed umbilicus. Greater diameter 22, lesser 17 mill.; height, 12 mill.

Helix Stearnsiana, Gabb, Am. Journ. Conch., III. 235, Pl. XVI. Fig. 1 (1867). — W. G. Binney, L. & Fr.-W. Sh., I. 177, Fig. 310 (1869). — Fischer and Crosse, Moll. Mex. et Guat., 248, Pl. XI. Fig. 5, 5a (1870).

A species of the Mexican fauna, common in Lower California, from San Tomas River, Todos Santos Bay, Coronado Island, Todos Santos Island; admitted here, because it is found plentifully within the limits of the California Region around San Diego.

The shell figured and described was received from Dr. Newcomb. It is entirely mature.

The genitalia (Pl. XIII. Fig. B) resemble very nearly those of *Kelletti*. A comparison of the figures, however, will show considerable difference, especially in the dart sac (13). In the species before me there is a long thread-like duct leading from the base of the dart sac to a large globular organ, (13^{d}) whose character is unknown to me. Opposite the entrance of this duct a corresponding duct (13c) branches out, but instead of ending in a globular organ, it becomes much enlarged in size, and ends in enveloping the prepuce (*p p*). The dart sac contained a small dart of the form figured by Leidy (Terr. Moll. U. S., I.) for *Tebennophorus Caroliniensis.* The oviduct was closely and spirally wound around the duct of the genital bladder. The testicle and ovary are yellow.

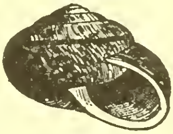
The jaw is thick, arched, ends blunt, but little attenuated; anterior surface with 6 stout, separated ribs denticulating either margin, and several less developed, interstitial ribs.

The lingual membrane is long and narrow with about 50—1—50 teeth. The centrals are of the form usual to the genus. The cusp with its cutting point is very short, reaching only about half-way to the lower edge of the base of attachment. Laterals of same type; the second has a side cutting point. Marginals low, wide, very variable in the denticles, but usually with one long, broad, sharply bifid inner denticle (the inner point much the smaller), and one short, sharp, rarely bifid outer denticle. There are 24 laterals. The twenty-second tooth has the side cutting point; on another membrane, the twentieth (Pl. IX. Fig. L).

Arionta exarata, PFEIFFER.

Shell umbilicated, depressed-conic, rather solid, malleated and wrinkled, yellowish, with one chestnut band; spire rather acute, conic; whorls 7, equally convex, gradually increasing, the last broader, rounded, scarcely falling in front, narrowed around the open, moderate umbilicus; aperture oblique, broadly lunate; peristome with a light white thickening, the terminations scarcely converging, the right slightly expanded, the columellar triangularly dilated above and widening. Greater diameter 30, lesser 25 mill.; height, 16 mill.

Fig. 244.



A. exarata.

Helix exarata, PFEIFFER, Proc. Zoöl. Soc., 1857, 108; Mon. Hel. Viv., IV. 268. — W. G. BINNEY, Terr. Moll., IV. 12; L. & Fr.-W. Sh., I. 168, Fig. 292 (1869).

Aglaja exarata, TRYON, Am. Journ. Conch., II. 312 (1867).

Californian Region, from near San Francisco to Santa Cruz or Marin County, only a range of eighty miles.

The largest individual I have seen has a greater diameter of 40 mill. There is an albino form.

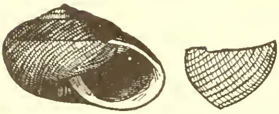
Jaw as usual; 6 ribs.

The lingual membrane (Pl. IX. Fig. O) has 54—1—54 teeth, 19 perfect laterals; the twenty-first tooth has its inner cutting point split; the nineteenth tooth is the first with side cusp and cutting point.

Genitalia as in *Nickliniana.*

Arionta ramentosa, Gould.

Fig. 245.



Helix reticulata (Pfeiffer).

Shell umbilicate, depressed-globose, solid, obliquely striated, and marked with oblong, somewhat regular granulations formed by striæ descending towards the anterior part; yellowish with one revolving reddish band; spire shortly conic; whorls 5½, somewhat convex, the last broad, rounded, not falling in front; umbilicus narrow, not pervious; aperture diagonal, roundly lunate; peristome white, thickened, its ends not converging, the right scarcely expanded, the columellar sloping, dilated above and reflected. Greater diameter 22, lesser 18 mill.; height, 11½ mill.

Helix ramentosa, Gould, Proc. Bost. Soc. Nat. Hist., VI. 11 (1845); Terr. Moll. U. S., III. 12. — Pfeiffer, Mon. Hel. Viv., IV. 349. — W. G. Binney, Terr. Moll., IV. 13.

Aglaja ramentosa, Tryon, Am. Journ. Conch., II. 314 (1862).

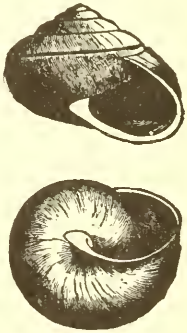
Helix Parkeri, Tryon, l. c., III. 105.

Helix reticulata, Pfeiffer, Mal. Blätt., 1857, 87; Mon. Hel. Viv., IV. 270; Nov. Conch., I. 120, Pl. XXXIV. Fig. 47. — W. G. Binney, Terr. Moll., IV. 12; L. & Fr.-W. Sh. I. 169, Fig. 294 (1869).

Helix Bridgesii, Newcomb, Proc. Cal. Acad. Nat. Sci., II. 91 (1861).

Aglaja Bridgesii, Tryon, Am. Journ. Conch., II. 313 (1866).

Fig. 246.



Helix Bridgesi.

Napa County, to Santa Clara County, California, in the California Region.

Fig. 245 is a fac-simile of one of Pfeiffer's.

Specimens of *Helix Bridgesi* received from Dr. Newcomb resemble forms of *A. ramentosa* so closely that I believe the two to be identical. An authentic specimen, loaned by Dr. Newcomb, is figured here. The name *Parkeri* was suggested, as *Bridgesi* was preoccupied in the genus *Helix*.

The above description is of the form known as *reticulata*. The original description of *ramentosa* here follows. There can be no doubt of the identity of the two forms.

Shell perforate, suborbicular, depressed, thin, reddish, with a smoky, white-margined band revolving at the periphery; granulated with incremental lines and equally oblique, decussating furrows; whorls 5½, rather convex, the last obtusely angulated; suture deeply impressed; aperture obliquely oblong-ovate; peritreme acute behind, white, decidedly reflected towards the umbilicus; throat reddish. Greater diameter, 20 mill.; height, 12 mill.

Jaw stout, strongly arcuate, dark horn-color, transversely striate; ends but slightly attenuated, blunt; anterior surface with 3 stout, widely separated ribs, on the central third of the jaw; their ends projecting beyond either margin.

Lingual membrane (Pl. IX. Fig. K) with 60—1—60 teeth, with 20 perfect laterals. The eighteenth tooth has the side cutting point, the twenty-first has a split inner cutting point.

Genitalia as in *Nickliniana*. It is figured in Proc. Acad. Nat. Sci., 1874, Pl. III. Fig. H. The ovary is brownish below, yellowish above. The epididymis and testicle are salmon-colored. The oviduct is white, the prostate salmon. The genital bladder is small, oval, with an extremely long duct, which has a flagellate branch. The duct enters at the lower end of the vagina. The penis sac is narrow, cylindrical, extremely long, with a flagellate extension. The retractor muscle is inserted beyond the middle of the length of the penis sac, the vas deferens at the commencement of the flagellum. There is a stout, long, cylindrical vaginal prostate, whose apex is extended into a flagellum, which shortly becomes bifurcate, there being a bulb-like expansion on each branch just beyond the bifurcation. In some individuals the bulb-like expansions are still larger and stouter than in the figure. The cylindrical extension of the vaginal prostate is abruptly truncated, the two flagella entering near the end, not at the extreme terminus.

Arionta Californiensis, Lea.

Vol. III. Pl. VI. Fig. 2.

Shell subperforate, ventricose, subglobular, thin and transparent, shining, delicately indented and granulated, faintly but regularly striate, of a pale yellowish horn-color, minutely flecked with pale spots and girded by a narrow brown band, paler at its edges; spire elevated, whorls 5, convexly rounded, the last very broad, vesicular; base ventricose; aperture subcircular, silky and banded within; the peristome slightly reflected, thickened within, more everted towards its columellar margin, where it is roundly reflected, nearly covering a very small umbilical perforation. Greater diameter 19, lesser 16 mill.; height, 15 mill.

Helix Californiensis, Lea, Trans. Am. Phil. Soc., VI. 99, Pl. XXIII. Fig. 79; Obs., II. 99 (1839); Troschel in Weigm. Arch., 1839, II. 221. — Binney, Terr. Moll., II. 121, Pl. VI. Fig. 2. — W. G. Binney, Terr. Moll., IV. 13; L. & Fr.-W. Sh. I. 170 (1869). — DeKay, N. Y. Moll., 46 (1843), not of Pfeiffer, (?) Chemnitz, Reeve.

Helix vincta, Valenciennes, Voy. de la Venus, Moll., Pl. I. Fig. 2, no descr. — Reeve, Con. Icon., No. 660. — Pfeiffer, Mon. Hel. Viv., III. 183; IV. 269; in Chemnitz, ed. 2, II. 487, Tab. CLX. Fig. 2 (1854).

Arionta Californiensis, Tryon, Am. Journ. Conch., II. 317 (1866).

A species of the California Region, near Monterey. I have a specimen with simply a broad white band. Readily distinguished by its thin, delicate shell and globose form.

Jaw arcuate, of uniform width throughout; ends blunt; anterior surface with 4 – 5 distant, stout ribs, crenulating either margin.

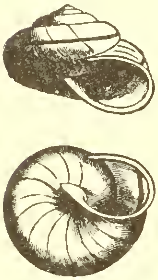
One lingual membrane had 176 rows of 56—1—56 teeth each. Another membrane (Pl. IX. Fig. S) had 53—1—53 teeth. All the teeth are as usual in the genus. The central and first laterals have no distinct side cusps or cutting points, though the latter are represented by lateral bulgings on the large cutting point. The side cutting points and cusps are distinctly developed on the ninth tooth. There are about 24 laterals, the inner cutting point of the twenty-fifth tooth being bifid. The thirty-ninth and fifty-third (and last) teeth shown in the plate are true marginals.

The genitalia are as in *A. Nickliniana.*

Arionta Carpenteri, Newcomb.

Shell umbilicated, roundly conical, apex obtuse, obscurely marked with one brown band, well striated, under the lens numerous very minute spiral striations; whorls 5½, rounded; suture well marked; aperture circular, with terminations approximating; peristome moderately expanded, at the columella broadly so, but not adherent. Greater diameter, 23 mill.; height, 16½ mill. (Newcomb.)

Fig. 247.



A. Carpenteri.

Helix Carpenteri, Newcomb, Proc. Cal. Acad. Nat. Sci., (March, 1861), II. 103.

Aglaja Carpenteri, Tryon, Am. Journ. Conch., II. 313 (1866).

Helix Remondi, Tryon, Proc. Acad. Nat. Sci. Philad., 1863, 281, Pl. II. Fig. 1.

Arionta Remondi, Tryon, Am. Journ. Conch., II. 318, Pl. V. Fig. 18 (1866).

Cinaloa; Trinidad; Coronado Island, Lower California; San Diego and Tulare Valley in the California Region. (Newcomb.)

The shell figured was received from Dr. Newcomb.

Jaw as usual; over 7 ribs.

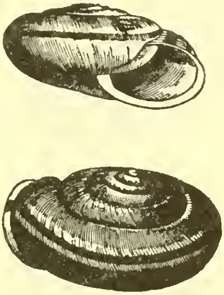
Lingual membrane long and narrow. Teeth 48—1—48, with 20 laterals. (See Pl. IX. Fig. U.) It will be seen that the central and first lateral teeth have no side cusps or cutting points; they appear first on the eighth tooth. The change from laterals to marginals is formed as usual, the inner cutting point of the twenty-first tooth being bifid. A marginal is shown in the thirty-fourth tooth.

Genitalia as in *A. Nickliniana.* The flagellate ends of the vaginal prostate are shorter in this species.

Arionta Mormonum, Pfeiffer.

Shell umbilicated, depressed, rather thin, with arching striæ, light red; spire scarcely elevated-conic; whorls 6, slightly convex, gradually increasing, the last convex above and below, rather swollen before, scarcely falling, ornamented above the middle with a chestnut band doubly edged with white, convex below ; umbilicus moderate, conical ; aperture very oblique, ear-shaped, lunate ; peristome with a white thickening, its ends converging, the right very much arched, expanded, the columellar curved and sloping, reflected, expanded above. Greater diameter 29, lesser 24½ mill. ; height, 12½ mill.

Fig. 248.



A. Mormonum.

Helix Mormonum,[1] Pfeiffer, Proc. Zoöl. Soc., 1857, 109 ; Mon. Hel. Viv., IV. 276. — W. G. Binney, Terr. Moll., IV. 16, Pl. LXXIX. Fig. 21 ; L. & Fr.-W. Sh., I. 171 (1869). — Fischer and Crosse, Moll. Mex. et Guat., 251 (1870).

Aglaja Mormonum, Tryon, Am. Journ. Conch., II. 314 (1867).

In the California Region ; Mormon Island, California ; San Joaquin Valley, north to Mount Shasta ; Fresno County to Klamath Lake. It is also said to have been found at the Dalles, Oregon, which would give it a much wider northern range. I doubt its existence in Sonora, from which it is also quoted.

The specimens lately received from California, which appear to be referable to this species, are singularly granulated on the first one and a half apical whorls, and the epidermis of the next two or three whorls is sparingly ornamented with small but very distinct raised lines or points, something like prostrate hairs, being part of and same color as the epidermis.

Animal uniform leaden-color, darker and with a lilac tint on head and tentacles.

Jaw as usual ; 8 ribs. (Cooper.)

Lingual membrane (Pl. XV. Fig. P) as usual in the genus ; teeth 50—1—50, with 15 laterals, the sixteenth tooth having its inner cutting point bifid.

Epiphragm as usual in the genus.

Genitalia (Pl. XIII. Fig. E). The general appearance is that of *A. fidelis*, as formerly described by me, but there is an additional accessory organ (*a p g*) of use unknown to me. The organ (*r*) is a dart sac. The dart is short, stout, straight, swollen at its base, and with an enlarged acutely pointed apex (Pl. XIII. Fig. F). Upon the vagina, above the insertion of the penis sac, is a ridge-like process (*x*), containing in three individuals examined one round and one oblong calcareous nodule (Pl. XIII. Fig. G).

Arionta sequoicola, J. G. Cooper.

Shell umbilicated, globosely depressed, rather thick, of a light chestnut-color, lighter below, with a band of darker color revolving above the middle of the body-whorl, between two equal bands of white; surface but slightly roughened by coarse, irregular wrinkles of growth, often decussated with coarse indented revolving lines, the upper whorls with prominent, crowded, minute, isolated granulations, running in ridges or series in an oblique direction to the wrinkles of growth; spire obtusely conic; whorls 6, but slightly convex, the last more globose, slightly descending before; umbilicus moderate, conical; aperture very oblique, subcircular; peristome white, thickened, ends approaching, its columellar portion widened and reflected, partially covering the umbilicus. Greater diameter 27, lesser 21 mill.; height, 12 mill.

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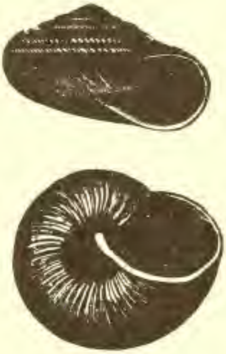
[1] Newcomb says (Proc. Cal. Acad., III. 119) that *H. cultellata*, Thompson, is identical with this species. It does not even belong to the same genus.

Fig. 249.



A. sequoicola.

Helix sequoicola, J. G. Cooper, Proc. Cal. Acad., III. 259 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 172, Fig. 300 (1869).

Aglaja sequoicola, Tryon, Am. Journ. Conch., III. 160, Pl. XI. Fig. 27 (1867).

In the California Region, from Santa Cruz County, California, twenty miles north.

Animal dark bluish-slate. Epiphragm as usual in the genus.

In form and coloring much allied to *Mormonum*, but readily distinguished by its peculiar sculpturing. It may be hirsute when in a perfect condition.

The shell described and figured was received from Dr. Cooper.

Jaw as usual; 4 to 6 ribs.

Lingual membrane (Pl. IX. Fig. J) with 46—1—46 teeth; 18 laterals, the nineteenth tooth having a split inner cutting point. I can detect no outer cusp and cutting point on any of the laterals.

The genital system (Pl. XIII. Fig. A) has the same general arrangement as in *Arionta Nickliniana*, excepting that in the present species there is at the end of the vaginal prostate a bulb-like process (x). In *A. Traski*, also, there is a similar process, but attached to the flagellate extension at the middle of its length before reaching the bifurcation.

The extreme length of the genital system is eighty-seven millimetres. The lower part of the oviduct is greatly convoluted.

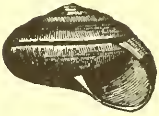
Arionta Diabloensis, J. G. Cooper.

Shell depressed-globose, umbilicated, thin, roughened with incremental wrinkles, and regularly malleated; reddish horn-color, the last whorl with a white-margined revolving band of red; spire but little elevated, apex obtuse; whorls 6, convex, the last not descending, globose; aperture oblique, banded within; peristome thickened, white, the columellar extremity reflected, partially covering the umbilicus. Greater diameter 22, lesser 17 mill.; height, 9 mill.

Helix Diabloensis, J. G. Cooper, Am. Journ. Conch., IV. 221, no descr.; Cal. Proc., III. 260, descr. without name.

Lysinoe Diabloensis, J. G. Cooper, Proc. Acad. Nat. Sci. Phila., 1872, p. 150, Pl. III. Figs. G, 1-4.

Fig. 250.



A. Diabloensis.

Californian Region, Mt. Diablo near San Francisco.

Jaw, as usual; 5 ribs.

Lingual membrane (Pl. IX. Fig. T) as usual in the genus. The central and first lateral teeth have no side cusps or cutting points; these appear on the thirteenth. The eighteenth tooth has its inner cusp bifid; there may, therefore, be said to be 17 laterals. The marginals are low, wide, with one inner, long, oblique, bifid cutting point, and one outer small cutting point. There are 37—1—37 teeth.

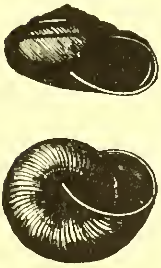
Genitalia as in *A. exarata.*

Dr. Cooper remarks: It is remarkable for having 7 whorls, while *A. sequoicola* and *A. Mormonum* of the same size have but 6; it is also less compressed than the latter, and the umbilicus is less covered. The color where remaining is shining gamboge-yellow (faded), with a single very narrow band above the middle, not showing the pale band on either side of it, which is so marked in others of the genus. The sculpture seems to have been very slightly indented, and with the faint lines of growth cut by smooth depressed waved grooves transversely, and thus obliquely to the sutures (while those of *A. Traski* are parallel). Greater diameter, 0.95 mill.; height, 0.40 inch. Mt. Diablo range.

Arionta Traski, Newcomb.

Shell umbilicated, globosely depressed, very thin, translucent, dark horn-colored, with a revolving chestnut band, doubly edged with white; with delicate oblique striæ and crowded microscopic revolving lines; spire hardly elevated, apex flattened; whorls 6, slightly convex, gradually increasing, the last rather plane above, inflated below, not falling before, banded above the middle; umbilicus moderate, conical; aperture very oblique, lunately semicircular, banded within; peristome with a white thickening, regularly rounding, its terminations joined by a light transparent callus, that of the columellar widened, subreflected, but not at all covering the umbilicus. Greater diameter 21, lesser 16 mill.; height, 9 mill.

Fig. 251.



A. Traski.

Helix Traskii, Newcomb, Proc. Cal. Acad. Nat. Sci., II. 91 (1861).

Aglaja Traskii, Tryon, Am. Journ. Conch., II. 314, Pl. V. Fig. 16 (1866).

Los Angeles, California, in the Californian Region.

The specimen figured was received from Dr. Newcomb. It may not be entirely mature.

The epiphragm is thick, white, parchment-like.

Jaw as usual in the genus; 8 ribs.

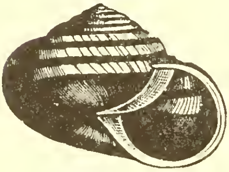
Lingual membrane (Pl. IX. Fig. M) has 36—1—36 teeth; the thirteenth tooth has the side cutting point; 16 laterals.

The genital system resembles very nearly that of *Nickliniana.* The duct of the genital bladder in this species is, however, very much longer, its accessory duct shorter in proportion, the flagellum of the penis sac longer. There is also a peculiar feature in the genitalia of *Traski,* a globular organ (probably a dart sac) of about equal diameter with the vaginal prostate, attached laterally to the flagellum of the latter, before it becomes bifurcated. The bulbous expansions on the two branches of the flagellum are also much larger in *Traski.* It is figured in Pl. XIII. Fig. H.

Arionta Dupetithouarsi, Deshayes.

Shell umbilicated, orbicularly convex, smooth or substriate, dark chestnut, lighter above, with a dark red, white-margined band; spire obtusely conoid; whorls 7 to 8, narrow, rather convex, the last inflated; aperture ovate semilunar, white, and banded within; peristome simple, narrowly reflected, its columellar end arched, dilated and arched above, not covering the moderate umbilicus. Greater diameter 29, lesser 25 mill.; height, 17 mill.

Fig. 252.



A. Dupetithouarsi.

Helix Dupetithouarsii, Deshayes, Rev. Zoöl., 1839, 360; in Guerin, Mag. 1841, Tab. XXX; in Fér., I. 169, Pl. XCVII. Figs. 8-10. — Pfeiffer, Mon. Hel. Viv., I. 338, excl. var.; III. 229; in Chemnitz, ed. 2, I. 328, Pl. LVIII. Figs. 6-7 (not Pl. LVI. Figs. 3-5). — Reeve, Con. Icon., 659. — Gould, Terr. Moll., III. 14. — W. G. Binney, Terr. Moll., IV. 15, Pl. LXXVI. Fig. 9; Pac. R. R. Rep., VI. 114 (1857); L. & Fr.-W. Sh., I. 174 (1869).

Helix Oregonensis, Lea, Trans. Am. Philo. Soc., VI. 100 (1839); Obs., II. 100, Pl. XXVIII. Fig. 9; Troschel, Arch. f. Nat., 1839, II. 221. — DeKay, N. Y. Moll., 46. — Pfeiffer, formerly, Mon. Hel. Viv., I. 428.

Aglaja Dupetithouarsi, Tryon, Am. Journ. Conch., II. 315 (1866).

Puget Sound to San Diego, according to the list of the Smithsonian Collection; but Dr. Cooper says it is only found at Monterey, California.

Animal light slate-color or dirty white.

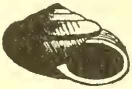
Jaw as usual in the genus; 4 ribs.

Lingual dentition (Pl. IX. Fig. R) as usual. Teeth 50—1—50. The centrals and first laterals have no decided side cusps, and no decided side cutting points, but the latter is represented by a lateral bulging on the large cutting point; the distinct side cusp and cutting point appear on the ninth tooth. There are about 19 laterals, the twentieth tooth having its inner cutting point bifid. The marginals are as usual in the genus.

The genitalia are like those of *sequoicola.* The penis sac is, however, more slender. There does not appear any retractor muscle of the penis sac. The oviduct is greatly convoluted.

Arionta ruficincta, NEWCOMB.

Fig. 253.



A. ruficincta.

Shell depressed-globose, umbilicated, rather thin, smooth, surface scarcely broken by incremental striæ, with occasional revolving lines, horn-color, with a median, revolving dark brown band, margined with white; spire little elevated; whorls 5 to 6, scarcely convex, the last flattened-globose, descending at the aperture, convex below; aperture banded within, oblique, roundly lunate; peristome white, thickened, its inner margin obtusely rounded, the right portion straight, basal and columellar portions reflected, partially concealing the umbilicus. Greater diameter 17, lesser 14 mill.; height, 9 mill.

Helix rufocincta, NEWCOMB, Proc. Cal. Acad. Nat. Sci., III. 117 (1864). — W. G. BINNEY, L. & Fr.-W. Sh., I. 174, Fig. 303 (1869).

Aglaja rufocincta, TRYON, Am. Journ. Conch., II. 315, Pl. VI. Fig. 20 (1866).

San Diego and Catalina Island, California, in the Californian Region.

There is a form from Santa Barbara Island with thick shell and closed umbilicus. Greater diameter, 31 mill.

Jaw more like the type common in *Mesodon* than in *Arionta*, that is, arcuate rather than arched, margins rather pectinated than scalloped by the ends of the ribs, which are about 10 in number.

Lingual membrane (Pl. IX. Fig. N) as usual in the subgenus, with 35—1—35 teeth, and 18 laterals, the nineteenth tooth having the inner cutting point split. Another membrane has a side cutting point on all the laterals.

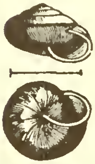
I have examined two individuals, whose genital systems vary considerably. That figured on Pl. XIV. Fig. B has a dart sac, but none of the other peculiar accessory organs of *Arionta.* That figured Pl. XV. Fig. O (from Catalina Island) has from one side of the base of the dart sac (x) a thread-like connection (z) with the base of the penis sac, and on the other side of the base of the dart sac the peculiar accessory organ y. These accessories to the dart sac are somewhat like those found in *Stearnsiana.*

Arionta Gabbi, NEWCOMB.

Shell subperforate, depressed-globose, thin, smooth, very delicately striated, dirty white, darker above, with a median revolving, white-margined brown band; spire little elevated; whorls 5, rather convex, the last flattened-globose, descending at the aperture; aperture lunately rounded, oblique; peristome white, thickened, somewhat reflected, the columellar portion almost covering the umbilicus. Greater diameter 10, lesser 8 mill.; height, 5 mill.

Helix Gabbii, Newcomb, Proc. Cal. Acad. Nat. Sci., III. 117 (1864). — W. G. Binney, L. & Fr.-W. Sh., I. 175, Figs. 304, 305 (1869).

Fig. 254.



A. Gabbi.

Aglaja Gabbii, Tryon, Am. Journ. Conch., II. 315, Pl. VI. Fig. 19 (1866); III. Pl. XI. Fig. 31 (1867).

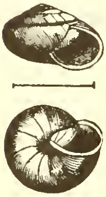
Helix facta, Newcomb, Proc. Cal. Acad. Nat. Sci., III. 118 (1864). — W. G. Binney, l. c., Fig. 306.

Aglaja facta, Tryon, Am. Journ. Conch., III. 162, Pl. XI. Fig. 32 (1867).

San Clemente Island, California.

Under the name of *H. tenuistriata* (certainly not of Binney) I have received a shell from Catalina Island, apparently a less developed form of *H. Gabbi.* It is here figured. (Fig. 255.)

Fig. 255.

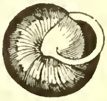


A. tenuistriata.

Although I am convinced of the identity of *facta* with *Gabbi*, I repeat below the description of the former, with a figure of an authentic specimen.

Shell imperforate or subperforate, globose or depressed-globose, smooth, shining, surface hardly broken by delicate incremental striæ and revolving lines, light fawn-color above, below lighter, with a median, white-margined, revolving band of a darker-colored hue; spire elevated, apex obtuse; whorls 5 to 6, rather convex, the last slightly descending, globose; aperture oblique, banded within; peristome thickened, brownish, shining, its inner margin rounded, reflected, the columellar portion dilated, appressed, partially or entirely covering the umbilicus. Greater diameter 14, lesser 12 mill.; height, 8 mill.

Fig. 256.



A. facta.

Santa Barbara Island, California. On this and San Nicholas Island is found a larger, heavier, extinct variety. South end of Catalina Island.

The species has the stout, white, parchment-like epiphragm characteristic of *Arionta.*

Jaw arcuate, of equal breadth throughout; anterior surface with distant, stout ribs, denticulating either margin.

Lingual membrane long and narrow (Pl. IX. Fig. P). Teeth 26—1—26, as usual in *Arionta.* Morse counted 114 rows of 29—1—29. The fourth has a decided side cusp and cutting point, which on the central and first three laterals were replaced by a prominent bulging of the large cutting point. The thirteenth tooth has its inner cutting point bifid. My figures give the central with the first, fourth, twelfth, thirteenth, seventeenth, and twenty-sixth teeth, the last two being marginals.

Genitalia (Pl. XVII. Fig. 9 of Ann. Lyc. Nat. Hist. of N. Y., Vol. XI.) without the accessory duct of the genital bladder, and with a dart sac. They resemble nearly those of *ruficincta* (see above), differing chiefly in the length of the duct of the genital bladder. At the base of the dart sac there appear two simple, thread-like organs, reminding me of those of *Stearnsiana*, but without their terminal complications. I have not figured them, being uncertain whether they should be considered as a part of the genital system. They may be the same as figured on Pl. XV. Fig. Q, or the individual furnishing the genitalia there figured may thus show the near relation of *facta* and *ruficincta*.

GLYPTOSTOMA.[1]

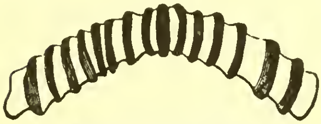
Animal as in *Patula*.

Shell widely umbilicated, depressed, with wrinkle-like striæ, solid; whorls 6, the last depressed-globose, not falling at the aperture; aperture oblique, subcircular; peristome simple, acute, thickened within, its extremities approached, that of the columellar short, scarcely reflected.[2]

Inhabits the Californian Region at San Diego.

One species only is thus far known, *Newberryanum*. Its jaw is low, wide, slightly arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous (about 16), stout, separated ribs, deeply denticulating either margin.

Fig. 257.



Jaw of *G. Newberryanum*.

Lingual membrane (Pl. X. Fig. A) long and narrow. Teeth 47—1—47, with 17 perfect laterals. Centrals with the base of attachment long and narrow, with greatly expanded lower, lateral angles, the upper margin rounded, broadly reflected; reflection large, stout, with obsolete side cusps, but with decided, triangular side cutting points; median cusp very stout, short, with a long, acute cutting point reaching beyond the lower edge of the base of attachment. Laterals like the centrals, but asymmetrical by the suppression of inner, lower, lateral angle of the base of attachment and inner side cutting point. The transition from laterals to marginals is marked by the lesser proportional development of the cusp and greater development of the cutting point. Marginals low, wide, the reflection equalling the base of attachment and bearing one inner, short, stout, oblique, blunt cutting point, and one outer, shorter, blunt cutting point.

This species, like all others, has great variation in the development of the cutting points on different parts of the same membrane.

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[1] The name is suggested by the sculptured parietal wall of the aperture in young specimens of the only species known, q. v.

[2] Testa late umbilicata, depressa, ruguloso-striata, solida, anfractus 6, ultimus depresso-globosus, antice non descendens; apertura obliqua, subcircularis; peristoma simplex, acutum, intus incrassatum, marginibus approximatis, columellari brevi, vix reflexiusculo.

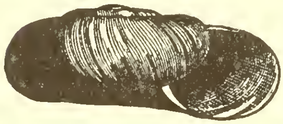
Maxilla arcuata, costis validis distantibus (circa 16) exarata; margines valdo dentati.

Lamina lingualis ut in Helice videtur; dentes marginales subquadrati.

Glyptostoma Newberryanum, W. G. Binney.

Shell broadly umbilicated, orbicularly depressed, solid, lightly decussated by incremental striæ, and numerous fine spiral lines; color black or reddish-brown, under the epidermis white and shining; suture deeply impressed; spire depressed; whorls 6, regularly increasing, the upper ones flattened, the last convex, rounded below, and slightly deflected at the aperture; umbilicus broad, showing all the volutions clearly; aperture oblique, transversely lunar; in young specimens the decussated sculpturing of the shell on the parietal wall of the aperture is covered with a light callus as the animal grows, and elegantly marked with numerous fine, crowded, spiral lines; in mature specimens this beautiful marking is entirely obliterated by the deposition of callus, but on breaking the shell, the lines will be found to exist within; peristome simple, acute, thickened within, ends slightly approximated, joined by a white callus. Greater diameter 37, lesser 20 mill.; height, 13 mill.

Fig. 258.



G. Newberryanum.

Helix Newberryana, W. G. Binney, Proc. Acad. Nat. Sci. Philad., 1858, 115; Terr. Moll., IV. 20, Pl. LXXVI. Fig. 7. — Pfeiffer, Mal. Blätt., 1859, 7; Mon., V. 161 (1868).

Macrocyclis Newberryana, Tryon, Am. Journ. Conch., II. 244, 5 (1866).

Zonites Newberryana, W. G. Binney, L. & Fr.-W. Sh., I. 282 (1869).

Los Angeles, California, to Todos Santos Bay, in Lower California; a species of the California Region. Very common around San Diego, on southerly exposed hillsides, under piles of detached rocks.

My largest specimen has a greater diameter of 47 mill.

Animal bluish slate-color.

The jaw (see Fig. 257) is long, low, slightly arcuate; ends blunt; anterior surface with about 16 stout, separated ribs, scalloping either margin. The jaw is lower, less arcuate, and longer than in *Arionta.* Its ribs resemble those of that genus in projecting far beyond and scalloping the margins of the jaw, but they are much more numerous.

This description applies only to the more perfect form of the jaw (Fig. 257), noticed only in one individual. In several other individuals the ribs on the jaw were much more narrow and less projecting at the upper and lower margins. There is more difference between these than is usually found in different individuals of the same species.

Lingual membrane (see last page).

Genitalia figured on Pl. XIV. Fig D. The epididymis is very long, convoluted in the lower half of its length, straight above. It runs free for a long distance outside the membrane which covers the oviduct, before entering into the liver, where it joins the testicle. The latter is imbedded in the liver, near its upper extremity. It is composed of several, apparently 6, separated fasciculi of blind tubes. The vas deferens enters the penis sac about its middle, not at its end. The penis sac is small, cylindrical. It terminates in a small bulb. There is no trace of lobuli in the ovary, but its under, concave surface is reticulated. The genital bladder is oval, its duct is long, free only for a short distance, then attached to the oviduct the whole length of the latter; at its base it becomes again free, and enters the vagina below the terminus of the oviduct. At about the same point, the vagina receives the mouth of a long, broad, rounded organ. This organ is hollow. Its use is unknown to me; it may be a dart sac or a prostate gland. The vagina is very long, the penis enters it at its lower extremity near the exterior opening of the genitalia.

EUPARYPHA, Hartm.

Animal heliciform; mantle subcentral; other characters as in *Patula*.

Shell usually perforate, depressed-globose, corneo-calcareous, banded; whorls 5, the upper ones flattened, carinate, the last inflated; aperture dilate-lunar, often labiate within, its columellar margin reflexed.

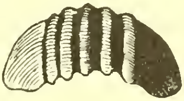
Inhabits the countries around the Mediterranean, Canaries, Madeira, etc. In North America it is represented in Lower California, one species being actually found in the California Region.

Jaw high, arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with a few (about 5 in *Tryoni*) stout, separated, unequal ribs, deeply denticulating either margin.

As usual in most of the species of *Helix*, etc., examined by me, the number, size, and disposition of the ribs vary in different individuals of the only species of *Euparypha* I have examined, *E. Tryoni*. In L. and Fr.-W. Shells N. A., I. 179, six jaws are figured, all differing as to the ribs. (See also next page.)

I have had no opportunity of examining *areolata*, the only other species found within our limits. Among the species of the genus foreign to the United States, *pisana*, Müll., alone has been examined, the jaw being figured by Moquin-Tandon with 2 – 3 ribs only, and the number of the teeth being given by Thomson.

Fig. 259.



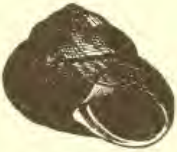
Jaw of *H. Tryoni*.

Lingual membrane as in *Arionta*.

Euparypha Tryoni, Newcomb.

Shell imperforate, globose-conic, solid, with distant, deep, strong revolving lines cutting through the striæ of increase, of a bluish ash-color above, mottled with irregular oblique patches of brown, and with a median revolving line of dark brown, below dirty white; spire conic; apex obtuse, smooth, shining, light horn-color; whorls 5 to 6, scarcely convex, the last globose, descending towards the aperture, inflated below; aperture oblique, subcircular, small, within dark above, lighter below; peristome thickened, dirty white, its terminations somewhat converging, joined by a light callus, right margin slightly expanded, not reflected, that of the columella dilated, scarcely reflected, appressed, obtusely subdentate. Greater diameter 24, lesser 20 mill.; height, 14 mill.

Fig. 260.



E. Tryoni.

Helix Tryoni, Newcomb, Proc. Cal. Acad. Nat. Sci., III. 116 (1864). — W. G. Binney, Am. Journ. Conch., I. 47, Pl. VI. Figs. 1-10 (1865); L. & Fr.-W. Sh., I. 178 (1869).

Polymita Tryoni, Tryon, Am. Journ. Conch., II. 319 (1866).

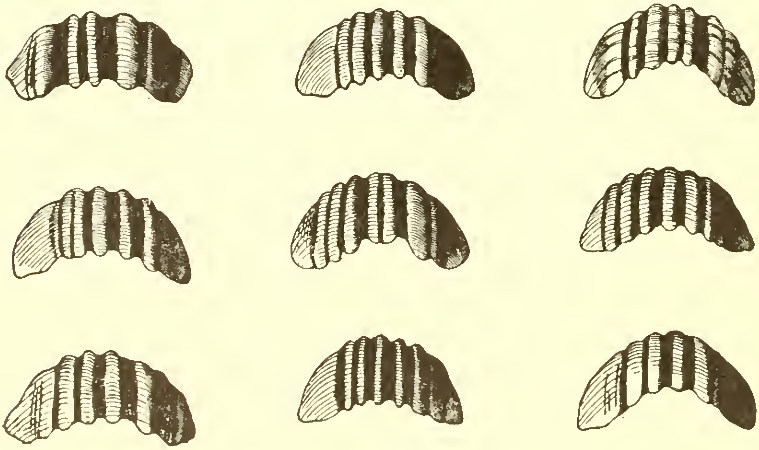
California Region, on Santa Barbara Island and San Nicholas Island, California, both recent and fossil, the latter form very large and thick; not on San Clemente.

The species varies in the greater or lesser development of the spire, and in coloring. The form figured differs from that described in having the under as well as upper surface mottled, not a dead white; an albino form is also found; also a fourth variety of a uniform cream-color, showing, however, slight traces of the revolving band.

The animal is black. It has a thick, white, parchment-like epiphragm.

Jaw arcuate, of uniform width throughout, ends blunt; anterior surface with stout ribs, denticulating either margin. Figures of the jaws of nine mature individuals are given, showing that the number and arrangement of the ribs is not constant; a fact noticed in other species.

Fig. 261.



Jaws of *E. Tryoni.*

Lingual membrane (Pl. X. Fig. B) long and narrow, quite as in *Arionta.* Teeth 42—1—42. Another membrane had 190 rows of 43—1—43 teeth. The eleventh lateral has a decided side cusp and cutting point. The fourteenth has its inner cutting point bifid. The characters of the individual teeth are shown in the figure, which gives the central, the first, eleventh, fourteenth, thirty-seventh, and forty-second teeth.

Genitalia (Pl. XIV. Fig. C) as usual in *Arionta*, especially in *A. Stearnsiana*, but with this important difference, that from the base of the dart sac (2) one thread-like organ (3) alone proceeds, the other being replaced by a sponge-like process (1), evidently a form of vaginal prostate.

EXTRALIMITAL SPECIES OF EUPARYPHA.

E. levis, PFEIFFER (see L. & Fr.-W. Sh., I. 180), a species of the Lower California fauna, has erroneously been quoted from Columbia River and Southern California.

TACHEA, LEACH.

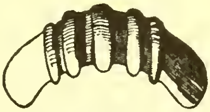
Animal heliciform, mantle subcentral; other characters as in *Patula.* (See Bost. Journ. Nat. Hist., I. Pl. VIII.)

Shell imperforate, globose or subdepressed, white or yellow, ornamented with distinct bands; whorls 5, the last convex, tumid, descending at the aperture; aperture broadly lunate, obsoletely angular; peristome thickened, reflexed, its columellar margin constricted, callous.

A genus of Middle and Southern Europe, one species also common to America, perhaps imported by commerce.

Our single species, *T. hortensis*, found only along the northeastern coast, and there usually restricted to the islands, agrees in its jaw with the other known species of the subgenus. It is stout, arched, with blunt, unattenuated ends; anterior surface with stout, few, separated ribs, denticulating either margin.

Fig. 262.



Jaw of *Tachea hortensis* (Morse).

The lingual membrane has 116 rows of 32—1—32 teeth each. The centrals have a subtriangular base of attachment, so greatly are the lower lateral angles expanded; upper margin reflected; reflection pear-shaped, without developed side cusps, but a single stout middle cusp, half as long as the base of attachment, and bearing a short, conical cutting point, reaching only about one half the distance to the lower edge of the base of attachment; this cutting point has lateral bulgings. First laterals like the centrals, but asymmetrical by the irregular cutting away of the lower inner angle of the base of attachment; outer laterals with a more developed cutting point and a decided side cusp and cutting point; the change from the laterals to the marginals is shown in the sixteenth tooth in Morse's figure in L. & Fr.-W. Sh., I., in the eleventh in the membrane figured by me, where the base of attachment is wider, the reflection stouter, and the inner cutting point becomes bifid. The marginals are low, wide, the reflection equalling the base of attachment, the inner cutting point short, bluntly bifid, the outer shorter and blunt, often bifid (Pl. X. Fig. C).

Tachea hortensis, Müller.

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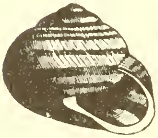
Fig. 263.



T. hortensis.

Shell imperforate, subglobose; epidermis shining, smooth, oblivaceous-yellow, and often variously ornamented with rufous horizontal bands or lines; whorls 5, convex; spire somewhat elevated; suture, at the extremity of the last whorl, curved towards the aperture; peristome slightly reflected, white, obsolete on the base, with the margin thickened internally; aperture rounded, slightly contracted at the base by the thickening and indentation of the peristome; umbilicus covered, indented; base convex. Greater diameter 20, lesser 17 mill.; height, 12 mill.

Helix hortensis, Müller, etc. — Pfeiffer, Mon. Hel. Viv., III. 195. — Mrs. Sheppard, Tr. Lit. Hist. Soc., Quebec, I. 193 (1829). — Gould, Invert., 172, ed. 2, 429 (1870). — Binney, Terr. Moll., II. 111, Pl. VIII. — W. G. Binney, Terr. Moll., IV. 51; L. & Fr.-W. Sh., I. 181 (1869). — Morse, Amer. Nat., I. 186, Fig. 16 (1867).

Helix subglobosa, Binney (formerly), Bost. Journ. Nat. Hist., I. 485, Pl. XVI. (1837). — DeKay, N. Y. Moll., 33, Pl. II. Fig. 14; Pl. III. Fig. 39.

Tachea hortensis, Morse, Journ. Portl. Soc., I. 10, Fig. 11; Pl. IV. Fig. 12 (1864). — Tryon, Am. Journ. Conch., II. 321 (1866).

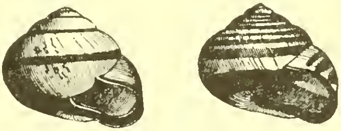
An European species, introduced by commerce (?) to the northeastern portion of North America. It is found on islands along the coast from Newfoundland to Cape Cod, and on the mainland plentifully in Gaspé, C. E.; also along the St. Lawrence; Vermont (?), Connecticut (?), etc. It also inhabits Greenland and Iceland (see Mörch, Am. Journ. Conch., IV. 45).[1]

Animal: head and neck blackish, with a slight tinge of brown; eye-peduncles and tentacles smoky; eyes black; base of foot inky, posterior extremity dirty flesh-color. Foot rather slender, terminating acutely. Respiratory foramen surrounded with a blackish circle. Genital orifice indicated by a blackish spot a little behind the right eye-peduncle. Length about twice the breadth of the shell. (See Bost. Journ. Nat. Hist., I. Pl. VIII.)

Having kept a large number of this species in confinement, Dr. Binney had frequently an opportunity of noticing the manner in which the epiphragm is formed, a process which seems not to have been heretofore correctly described. The aperture of the shell being upwards, and the collar of the animal having been brought to a level with it, a quantity of gelatinous matter is thrown out, which covers it. The pulmonary orifice is then opened, and a portion of the air within suddenly ejected, with such force as to separate the viscid matter from the collar and to project it, like a bubble of air, from the aperture. The animal then quickly withdraws further into the shell, and the pressure of the external air forces back the vesicle to a level with the aperture, when it hardens and forms the epiphragm. In some of the European species in which the gelatinous secretion contains more carbonate of lime than ours, solidification seems to take place at the moment when the air is expelled, and the epiphragm in these is strongly convex.

The *T. nemoralis* of Europe, distinguished readily from *T. hortensis* by its black peristome, but by many considered identical, does not appear to have been introduced from Europe into the New England States or British Provinces. In 1857 I imported some hundred living specimens from near Sheffield, England, and freed them in my garden, in Burlington, New Jersey. They have thriven well, and increased with great rapidity, so that now (1878) the whole town is full of them. They retain the habit of the species of climbing hedges and trees, not remaining concealed under decaying leaves, logs, etc., like the American snails. Fig. 264 is drawn from Burlington specimens. The experiment of introducing the *T. nemoralis* is interesting, as showing the adaptability of the species to a new climate. Other species, among them *Campylæa lapicida* from England, and *Stenogyra decollata* from Charleston, South Carolina, placed in my garden at the same time, disappeared at once.

Fig. 264.



T. nemoralis.

The jaw of a Burlington specimen is very strongly arched, with 4 stout ribs on its anterior surface, denticulating each margin.

For lingual membrane (see above, p. 377).

The genitalia of the European *T. hortensis* is figured by Schmidt (Geshlechts. der Stylomm., Pl. III. Fig. 15). The genital bladder is small, globular, on a very long and delicate duct, to which is a short accessory duct. The penis sac is long, cylindrical, tapering above the insertion of the retractor muscle to the point where the vas deferens enters, beyond which it has a long flagellate extension. About half-way between the end of the duct of the genital bladder and the common orifice is an elongate-ovate dart sac, from the base of which, on either side, is a bundle of greatly developed multifid vesicles, each composed in the specimen figured of four long cæca.

POMATIA, (Leach) Beck.

Animal heliciform; mantle subcentral; other characters as in *Patula*.

Shell imperforate or subimperforate, globose, striate, horny-calcareous, erally banded; whorls 4 – 6, convex, the last large, ventricose, descending;

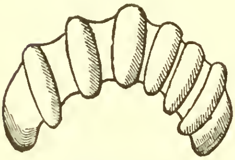
aperture lunate-orbicular, peristome patulous or straight, within labiate with callus, the columellar margin reflected, generally callous.

Found around the Mediterranean Sea; a few species found elsewhere, Mexico, Japan, etc. One species only introduced by commerce within our limits.

Jaw of our only species, *P. aspersa*, introduced by commerce at Charleston, South Carolina (where it is still common), high, thick, arcuate; ends but little attenuated, blunt; cutting margin without median projection; anterior surface with 6 stout, separated ribs, deeply denticulating either margin (see Fig. 265).

Lingual membrane of the same species (Pl. X. Fig. D) long and narrow.

Fig. 265.



Jaw of *P. aspersa.*

Teeth 50—1—50, with 15 perfect laterals. Centrals with base of attachment longer than wide, the lower lateral angles but slightly produced, the lower margin in some cases with a quadrate excavation or thinning as usually found in *Succinea;* the upper margin broadly reflected, reflection very large, with a very stout, short median cusp, bearing a short, stout cutting point reaching the lower edge of the base of attachment; side cusps obsolete, but bearing well-developed, short side cutting points. Laterals like centrals, but asymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the inner side cutting point. Transition teeth from the laterals to the marginals with a more developed reflection, a shorter inner cusp bearing a greatly developed bifid cutting point. Marginals low, wide, the reflection equalling the base of attachment, and bearing one inner, long, oblique, acutely bifid cutting point, and one shorter, outer, sometimes bifid, side cutting point.

The only other *Pomatia* whose dentition has been figured is *pomatia*, which shows the same type of teeth (Goldfuss, l. c. Pl. IV. Fig. 6), and *Sieboldtiana*, Pfr. (see Proc. Am. Nat. Soc. Phila., 1875, Pl. XXI. Fig. 8), which differs in detail. The jaw of these and of numerous European species is known, and of the same type as in *aspersa.*

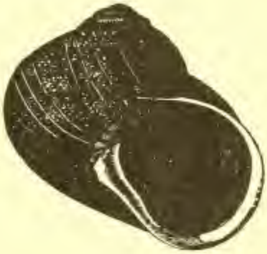
Pomatia aspersa, MÜLLER.

Shell imperforate, subglobose, rather thin, the surface rather coarsely and irregularly striate, and finely wrinkled and indented; the ground-color is yellowish or grayish, with chestnut-colored bands of various width, across which are narrow undulating flammules of yellowish; the spire is rather obtuse, composed of 4 or 5 moderately convex whorls, the principal one being very large and ventricose; the aperture is large, a little oblique, rounded lunate; the peristome white, sharp, turned slightly outward, and in the region of the umbilicus turning over the columella in a broad appressed callus, which is continued to the upper junction of the peristome. Greatest diameter, 32 mill.; height, 22 mill.

Helix aspersa, Müller, Verm., II. 59. — Pfeiffer, Mon. Hel. Viv., I. 241. — DeKay, N. Y. Moll., 47 (1843). — Binney, Terr. Moll., II. 117, not in plate. — W. G. Binney, Terr. Moll., IV. 51, Pl. LXXVII. Fig. 4; L. & F.-W. Sh., I. 183, (1869).

Pomatia aspersa, Tryon, Am. Journ. Conch., II. 322, 16 (1866).

Fig. 266.



P. aspersa.

In gardens in Charleston, South Carolina, and vicinity, where it has existed for fifty years; I found it plentifully in St. Michael's churchyard in 1875; also has been found at New Orleans and Baton Rouge; Portland, Maine; Nova Scotia; Santa Barbara, California; Hayti; St. Iago, Chili, etc. It is a European species, accidentally introduced into this country, or rather by commerce as an article of food. It evidently is a species peculiarly adapted to colonization.

Jaw and lingual membrane (see above).

Genitalia figured by Schmidt (Geschlechts. der Styl., Pl. I. Fig. 5). The genital bladder is small, globular, or a long narrow duct, which has a long accessory duct also. The sac is small, globular, on a long duct, which has at about the middle of its length a much longer and stouter accessory duct. The penis sac is long, cylindrical, greatly swollen at its junction with the vagina; the retractor muscle is inserted above this swelling, the vas deferens enters at the apex, beyond which is an excessively long, thread-like flagellum. Opposite the entrance to the penis sac is a very long, stout dart sac, above which are two bundles of numerous, short, closely packed multifid vesicles.

Extralimital Species of Pomatia.

Pomatia Buffoniana, Pfeiffer, a Mexican species, has been erroneously quoted from Alameda County, California. It is figured on Pl. LXIII. of Vol. III.

(3) Jaw with delicate, distant ribs to its anterior surface, usually running obliquely to the median line.

CYLINDRELLA, Pfeiffer.

Animal heliciform, blunt and short before, rapidly attenuated behind; mantle slightly posterior, simple, thin, protected by an external shell; respiratory, anal, and genital orifices as in *Patula;* no caudal pore, no distinct locomotive disk.

Shell cylindrical or pupæform, multispiral, generally truncated; with remarkable differences in the form of the axis, often furnished with revolving laminæ or other curious processes; aperture subcircular, edentulate; peristome expanded, continuous.

A West-Indian genus, represented only in the Florida Subregion within our limits.

Jaw as in *Macroceramus*, described below.

The dentition of the genus is very peculiar and constant in the various groups or subgenera. The lingual membrane is exceedingly long and narrow. The base of attachment of the centrals is small, long, narrow, with the upper margin broadly reflected into a blunt, rounded, and expanded, gouge-shaped cutting point; the laterals have a long, subquadrangular base of attachment, bearing, below, a large, bluntly rounded, greatly expanded, palmate cusp and cutting point, representing the inner and central cusps of the laterals; and, above, a long, slender, graceful extension, representing the external cusp of the other *Helicidæ*. This last is bluntly truncated, or bears a recurved cusp smaller but of same shape as that below; or it has a laterally extended, small blunt point. In some species the laterals extend to the margin of the lingual membrane; in others there are distinct marginal teeth, long, narrow, laminar, with bluntly recurved apices. A full description and figures of these various forms of teeth will be found in Journal de Conchyliologie, January, 1870.

SUBGENUS GONGYLOSTOMA, ALBERS.

Animal small and short compared with the shell, in general like that of *Patula;* eye-peduncles of medium length, the tentacles quite short. Motions sluggish; the shell drags horizontally, nearly in the line of motion.

Shell cylindrically fusiform or conic-turreted, apex attenuated, costellately striate; whorls 9 – 20, the last more or less protracted, terete, sometimes obsoletely angulated; aperture circular, peristome expanded in every part.

The lingual membrane of three species only is known: *C. elegans*, *C. ornata*, and *C. Poeyana*. They all agree in their characters. On the laterals the inner cutting palmate cusp (it can hardly be called a cutting edge or point) is surmounted by a simple, long, squarely truncated extension; the outer palmate cusp is on a long pedicle; the change from lateral to marginal teeth is very gradual; the last become very small, wider than high, with one inner, large, and one outer, small palmate cusp; the two pedicles are quite wanting.

Cylindrella Poeyana, D'ORBIGNY.

Vol. III. Pl. LXIX. Fig. 2.

Shell very long, thin, horn-colored or whitish, longitudinally strongly striated; spire very long, inflated, acuminate behind, truncated; whorls 11, rather convex, the last carinated before; aperture round; peristome acute and continuous, in contact with the preceding whorl. Axis simple. Length, 15 mill.; breadth, 4 mill.

Pupa Poeyana, D'ORBIGNY, Moll. Cuba, I. 185, Pl. XII. Figs. 24 – 26.

Cylindrella Poeyana, PFEIFFER, Mon. Hel. Viv., II. 380. — CHEMNITZ, ed. 2, 20, Pl. III. Figs. 29 – 31. — W. G. BINNEY, T. M., IV. 149; L. & Fr.-W. Sh., I. 22 (1869).

Cylindrella lactaria, GOULD in T. M., Pl. LXIX. Fig. 2, not in text.
Gongylostoma Poeyana, TRYON, Am. Journ. Conch., III. 311 (1868).

A Cuban species, found also in the Florida Subregion, both on the mainland in the Miami Country, and on Key West and other Keys.

Animal white, with a dark line along the back of each eye-peduncle, one along the median line, and a very delicate one along each cheek; ocular points large and black.

The description in the Terrestrial Mollusks is drawn from *C. lactaria*, Gould, which is identical with *variegata*, Pfeiffer, and is characterized by flexuose, milk-white lines and more delicate striæ.

The apicial nucleus of the shell is a small globule; this is succeeded by a large number of closely revolving whorls of still smaller diameter, which scarcely augment in length; and then there is a rapid dilatation to the full size of the shell. At this part, either by fracture, or more probably by absorption, the slender tip is thrown off, so that we have only the truncated lower portion left.

The animal is very small compared with the shell, being less than one fourth the length of the shell, which it carries with its axis nearly horizontal, and in the line of motion, with apparent difficulty. The snout is thrown forward, and firmly attached at every undulation, simultaneously with the contraction of the posterior extremity. When the curve flowing along the sides of the foot reaches the head, the attachment of the snout is released, and it is again thrown forward and fixed as before.

Jaw as usual in the genus, with about 40 delicate ribs.

Lingual membrane (Pl. X. Fig. R) as described above; teeth 14—1—14.

Genitalia not examined.

Cylindrella jejuna, GOULD.

Vol. III. Pl. LXIX. Fig. 3.

Shell rather small, fusiform, truncated at apex, quite solid, of a pale horn-color, longitudinally striped with delicate, white lines; spire composed of about 9 whorls, though when entire the whole number would be about twice as many; they are convex, and separated by a well-marked suture; the last whorl has a delicate carina, and extends in a short neck; the aperture is bell-shaped, the peristome white, continuous, and not in contact with the preceding whorl. Axis simple. Length, 10 mill.; breadth about 2½ mill.

Cylindrella jejuna, GOULD, Proc. Bost. Soc. Nat. Hist., III. 41, June, 1848; Terr. Moll., II. 310, Pl. LXIX. Fig. 3. — W. G. BINNEY, T. M., IV. 150; L. & Fr.-W. Sh., I. 23 (1869).
Cylindrella variegata, PFEIFFER, part, Mal. Blätt., II. 13.
Gongylostoma jejuna, TRYON, Am. Journ. Conch., III., 312 (1868).

Found abundantly in the Florida Subregion, near the mouth of the Miami River.

Spurious Species, etc., of Cylindrella.

Cylindrella pontifica, Gould, is *Macroceramus Kieneri*, Pfr.

Cylindrella Goldfussi and *Roëmeri* are species of *Holospira*.

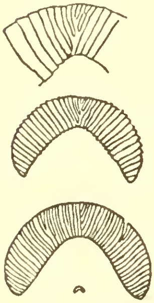
Cylindrella campanulata of Terr. Moll. U. S., I. 109, is unknown to me.

MACROCERAMUS, Guild.

Animal as in *Cylindrella* (q. v.) See also below under *M. Kieneri.*

Shell turreted or lengthened-conic, rimate; whorls 9 – 15, gradually increasing, the last often angular; aperture round, short, columella usually plicate; peristome expanded, its margins subequal, subparallel, not continuous, the external arched, the columellar dilated, reflected.

Fig. 267.



Jaw of *M. signatus* (Bland).

Jaw thin, almost membranous, semi-transparent, light horn-colored, strongly arched, ends acuminated; cutting margin without median projection; anterior surface with numerous delicate, separated ribs, denticulating both margins; these ribs run obliquely towards the median line of the jaw, so that the central ribs meet before reaching the lower margin of the jaw, forming an upper median triangular space between the ribs.

It was formerly considered that this jaw was actually in separate pieces, whose overlapping margins formed the ribs upon the anterior surface (see Fig. 267). More careful examination, however, has proved the jaw to be in one single piece, with delicate ribs upon its surface.

There are over 50 ribs on the jaw of the only one of our species I have examined, *M. Gossei.* I give a copy of Mr. Bland's figure of the jaw of *M. signatus*, which is similar.

The lingual membrane of *Macroceramus* was supposed to be the same as in *Cylindrella* described above, as that of *M. signatus* was so found by Mr. Bland (Ann. Lyc. Nat. Hist. N. Y., VIII. 162), and Crosse and Fischer (Journ. de Conch., 1870, Pl. III. Figs. 14 – 16). It was, therefore, with surprise that I found an entirely different type of dentition in *M. Gossei.* I can in this place only note the difference, and leave to future study the question of its bearing on the generic position of the species.

M. Gossei (Pl. X. Fig. Q) has a membrane very long and narrow; teeth about 40—1—40, in scarcely oblique transverse rows, decidedly not *en chevron.* Centrals with a long, narrow base of attachment with somewhat expanded lower lateral angles, its upper margin squarely reflected. The reflected portion is very small, and bears three short, blunt cusps, the median the largest, all three with distinct cutting points. The base of attachment of the laterals is long and narrow, its outer lower angle irregularly cut away; the upper margin broadly and obliquely reflected, the reflected portion thrown off obliquely towards the margin of the lingual membrane, very short and bearing two stout, blunt, short cusps, the inner the larger, also thrown obliquely towards the outer margin of the membrane; both of the cusps bear distinct cutting points, the outer one small, the inner one narrow, blunt, almost as long as the base of attachment. There are no distinct marginals, the laterals decreasing in size as they pass off laterally, those at the edge of the membrane having one large inner cutting point, and several outer irregular smaller ones. I have given a group of centrals and laterals, a group of laterals, and an extreme lateral or marginal.[1]

I have had no opportunity of examining *M. Kieneri.*

Macroceramus Kieneri, PFEIFFER.

Vol. III. Pl. LXIX. Fig. 1.

Shell fusiform, attenuated-cylindrical, whitish, or grayish clouded and marbled with brown; spire acuminate; whorls from 9 to 13, rounded, with numerous oblique, prominent striæ or ribs; suture impressed, crenulated by the extension of the alternate ribs across it; aperture rounded, oblique; peristome thin, somewhat reflected; axis impressed, not truly perforate; on the last whorl a colored line revolves; this is sometimes raised a little from the surface, and sometimes is sharp like a delicate carina. Length, 18 mill.; diameter of antepenultimate whorl, 6 mill.; of aperture, length 4½, breadth 4⅓ mill.

Pupa unicarinata, BINNEY, Terr. Moll., I. — Not LAMARCK.

Bulimus Kieneri, PFEIFFER, Proc. Zoöl. Soc., 1846, 40; Mon. Hel. Viv., II. 79; in CHEMNITZ, ed. 2, 131, Pl. XLII. Figs. 23, 24. — REEVE, Con. Icon., 463.

Cylindrella pontifica, GOULD, Proc. Bost. Soc. Nat. Hist., III. 40 (1848); Terr. Moll., II. 306, Pl. LXIX. Fig. 1. — CHENU, Man. de Conch., I. 446, Figs. 3305, 3306 (1859).

Macroceramus pontificus, W. G. BINNEY, Terr. Moll., IV. 137.

Macroceramus Kieneri, PFEIFFER, Mon. Hel. Viv., IV. 689, not of Vol. VI. — TRYON, Am. Journ. Conch., III. 301 (1868). — W. G. BINNEY, L. & F.-W. Sh., I. 221 (1869).

In the Florida Subregion, both on the mainland from the Miami Country to Tampa Bay and on the islands from Key West to Key Biscayne. The true *M. Kieneri* has also been found in Mexico, in Cuba and Jamaica.

Animal whitish, translucent, a little darker above the head; body very short, terminating in a blunt extremity, eye-peduncles of moderate length, of nearly equal diameter throughout, terminating in a rounded bulb; tentacles very short, nearly rudimentary; ocular points large and black.

When in motion, the axis of the shell is parallel with the line of progress, and lies almost horizontally. The rapidity with which the animal moves is quite surprising. The advance seems to be effected in this way: The posterior point of the disk of the foot, being detached from the object on which it rests, is carried forward by muscular contraction, and again fixed, leaving a curve between the attached point and the next anterior part of the disk, which is not yet detached. This operation is continued throughout the whole disk, every part of which becomes successively detached, curved upward, and again attached, from the extremity to the snout, exhibiting in action a curved or wavy motion, or undulation, commencing at the extremity, proceeding rapidly forward, and terminating at the head. But before one muscular wave is exhausted at the head, another has begun to flow, so that two series of undulations are visible at one time. With this double alternation of action the body is propelled with a rapidity greater than can be attained by the more common gliding motion of the *Helices*. During motion the eye-peduncles are extended, and remain steadily in one position.

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[1] Similar dentition is found in *M. turricula,* Pfr., of Cuba. See Proc. Acad. Nat. Sci. Philad., 1875, Pl. XX. Fig. 9.

They are found in woods, on the ground, under leaves, but are not very plentiful. The most northern point where they have hitherto been noticed is Tampa. On the eastern shore of the peninsula they occur at Cape Florida and Key Biscayne.

There is considerable confusion regarding the identity of this species. Pfeiffer (in Vol. VI.), and Fischer and Crosse (Moll. Mex. et Guat.), consider *pontificus* as distinct from *Kieneri*.

Jaw and lingual membrane and genitalia not observed.

Macroceramus Gossei, PFEIFFER.

Shell rimate, turrito-cylindrical, obliquely ribbed, white, opaque, with semilunar blotches and pellucid, horn-colored spots; spire cylindraceous, apex attenuated and acute; suture crenulated; whorls 11, convex, the last about one fourth the length of the shell, rounded, subangulate at base; aperture subcircular; peristome briefly expanded, with approaching termini, the columellar expansively reflected. Length, 11 mill.; diameter, $3\frac{2}{3}$ mill.; aperture, $3\frac{1}{3}$ mill. long, $3\frac{1}{4}$ mill. broad.

Fig. 268.

M. Gossei.

Bulimus Gossei, PFEIFFER, Proc. Zoöl. Soc., 1845, 137; Mon. Hel. Viv., II. 81; in Roemer's Texas, 456. — REEVE, etc. — W. G. BINNEY, Terr. Moll., IV. 135.

Cylindrella Hydeana, concisa, etc., see PFEIFFER.

Macroceramus Gossei, PFEIFFER, Mon. Hel. Viv., IV. 689. — TRYON, Am. Journ. Conch., III. 302 (1868). — W. G. BINNEY, L. & Fr.-W. Sh., I. 222 (1869).

Var. *β*. Somewhat smaller, the spots and blotches more obsolete.

A West Indian species, found also in the Texan Subregion and in the Florida Subregion at Little Sarazota Bay, near Charlotte Harbor, Florida.

Jaw and lingual dentition (see p. 384).

BULIMULUS, Leach.

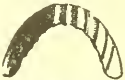
Animal heliciform; mantle subcentral; other characters as in *Patula*, etc.

Shell oblong; aperture longitudinal, edentulate; peristome thin; margins unequal; columella integral.

In the present state of our knowledge I think it best to leave our species simply under the above generic name, without attempting to group them into subgenera. As suggested by von Martens, *Bulimulus* must eventually be restricted to those species whose dentition is like that of *B. Guadelupensis*, the type of the genus. All of ours whose dentition is now known agree with that species in this respect, except *B. Dormani*.

Jaw thin, arcuate, ends but little attenuated; no median projection to the cutting edge; anterior surface with numerous, separated, delicate ribs, denticulating either margin, sometimes the upper median ones running obliquely towards the median line, or even arranged *en chevron* as in *Macroceramus*, with an upper median triangular compartment.

Fig. 269.



Jaw of *B. dealbatus*.

The jaw of *B. dealbatus* is here figured. It is quite arched. That of *B. Marielinus*, *Schiedeanus*, and *alternatus* is of the same type. I have given on Pl. XVI. Fig. 12 of Proc. Phila. Acad. Nat. Sci., 1875, a more enlarged view of one end of the jaw of *B. sufflatus*, to show more accurately the character of the ribs.

The lingual membrane of the genus as now received varies too much to allow of a general description. It can only be said that the marginal teeth are quadrate, not aculeate. I have below described the membrane of the only ones of our species of which I have examined the lingual membrane.

The general arrangement of the teeth on the membrane of *B. dealbatus* is as in *Patula*, the characters of the individual teeth being shown in Pl. X. Fig. E. There are 94 rows of 25—1—25 teeth in one specimen examined. Another had 20—1—20 teeth, with 14 perfect laterals. The central tooth has a base of attachment longer than wide, with but little expanded lower lateral angles, its lower margin incurved, its upper margin broadly reflected. The reflection is large, and has subobsolete side cusps, bearing well-developed cutting points, and a short, stout median cusp, bearing a short, stout cutting point not quite reaching the lower margin of the base of attachment. The laterals are of the same general form as the centrals, but are larger, broader in proportion, and are rendered asymmetrical by the suppression of the lower inner angle of the base of attachment, and inner side cusp and cutting point. The marginal teeth are but a simple modification of the laterals, formed by the proportionally greater development of the reflection in comparison with that of the base of attachment, and the greater development of the cutting points. On the extreme marginals the cutting points are shorter and much blunter.

The dentition of *Bulimulus alternatus* is figured on p. 203 of L. & Fr.-W.

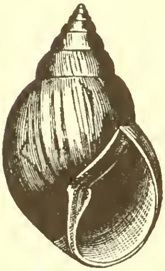
Sh., I. I have preserved no specimen from which I can more accurately draw the individual teeth. It has 75 rows of 37—1—37 teeth, all apparently of the same character as in *B. dealbatus*, as is also the case in *B. Schiedeanus.*

I have not examined *B. multilineatus*, *Marielinus*, *Floridanus*, *patriarcha.* That of *B. Dormani* is very different from *alternatus*, *Schiedeanus*, and *dealbatus.* It will be described below, under *B. Dormani.*

Bulimulus patriarcha, W. G. Binney.

Shell perforate, ovate, heavy, white, and wrinkled; whorls 6, convex, the last ventricose, equalling in length five sevenths of the shell; aperture ovate; peristome simple, thickened within, the extremities joined by a heavy white callus, the columellar extremity slightly reflected, so as partially to conceal the umbilicus. Length 35, diameter 19 mill.; aperture, length 19, diameter 12 mill.

Fig. 270.



B. patriarcha.

Bulimus patriarcha, W. G. Binney, Proc. Acad. Nat. Sci. Philad., 1858, 116; Terr. Moll., IV. 130, Pl. LXXX. Fig. 13; L. & Fr.-W. Sh., I. 200 (1869). — Pfeiffer, Mal. Blätt., 1859, 48.

Thaumastus patriarcha, Tryon, Am. Journ. Conch., III. 171 (1867).

Mexico, at Buena Vista (*Berlandière*); also in the Texan Subregion.

Named from its greater size and more antiquated appearance, as compared with the allied species, but the young individuals are as readily distinguished as the most mature from any other. It is most nearly related to *B. Schiedeanus*, but differs from that species in having a shorter, more rapidly acuminated spire, longer and much more globose body-whorl, more lengthened and narrower aperture, and rougher surface.

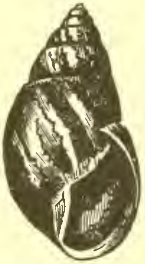
Animal not observed.

Bulimulus alternatus, Say.

Vol. III. Pl. LI. a, upper and lower Fig., LI. b.

Ovate-conic, with alternate gray and brownish longitudinal vittæ. Inhabits Mexico. Shell umbilicated, ovate-conic, with longitudinal lines, subequal, gray and light brownish vittæ; the brown is paler, almost approaching in some instances a drab; the white vittæ consist of more or less confluent, transverse, irregular lines, and small spots; whorls about 6, a little convex; suture not profoundly impressed; labrum (in some specimens) with a thickened line or rib on the inner submargin, within white, with a perlaceous tinge. Length, 1⅛ of an inch; greatest breadth, $\frac{7}{10}$. This species appears to be not uncommon in Mexico, as many specimens were sent me by Mr. Maclure; but from what particular locality I know not. (Say.)

Fig. 271.



B. alternatus (Say).

Bulimus alternatus, SAY, New Harmony Diss., Dec. 30, 1830; Descr., 25; ed. BINNEY, 39. — PFEIFFER, Mon. Hel. Viv., II. 221. — W. G. BINNEY, Terr. Moll., IV. 126, Pl. LXXX. Figs. 1, 3, 18; L. & Fr.-W. Sh., I. 200 (1869).

Bulimus dealbatus, BINNEY, part, Terr. Moll., II. 276, Pl. LI. a, upper and lower fig., Pl. LI. b. — Not SAY.

Bulimus Mariæ, ALBERS, Heliceen, 162. — PFEIFFER, Proc. Zoöl. Soc., 1858, 23; Mon. Hel. Viv., III. 350; in CHEMNITZ, ed. 2, 157, Pl. XLVIII. Figs. 7, 8. — W. G. BINNEY, Terr. Moll., IV. 128.

Bulimus Binneyanus, W. G. BINNEY, Terr. Moll., IV. 128. — Not PFEIFFER.

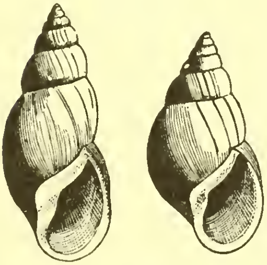
Thaumastus alternatus, TRYON, Am. Journ. Conch., III. 171, Pl. XIII. Fig. 16 (1867).

Thaumastus Mariæ, TRYON, Am. Journ. Conch., III. 172, Pl. XIV. (1867).

Texan Subregion. From Louisiana through Texas into Mexico. It belongs rather to the fauna of Mexico, extending into the Isthmus of Tehuantepec.[1] Found in great numbers upon bushes, the ground below them being often covered with dead shells.

This species is readily distinguished from the allied forms by its greater solidity, its highly polished surface, its more elongated form, its dark-colored aperture, bordered with the white internal margin of the peritreme, and the tooth-like callus upon the upper portion of the columella. It varies considerably in form, being sometimes quite slender, at others quite globose. In color it shows every variation from uniform brownish to pure white. The aperture, however, is always dark, and has a white, thickened rim within the peristome. It is most attractive when ornamented with alternate white and brown longitudinal blotches.

Fig. 272.



B. alternatus.

There can, I believe, be no doubt that the shell under consideration is what Mr. Say described as *alternatus*. His description is given above, and a copy (Fig. 271) of a colored drawing by Mrs. Say, under which is written, in Mr. Say's hand, "*Bulimus alternatus*, Mexico, Wm. Maclure."

The species was known to Dr. Binney and figured in the Terrestrial Mollusks, but as a variety of *B. dealbatus*. Plate LI. b, and the upper and lower figures of Plate LI. a, certainly represent the species. The central figures of

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[1] Forbes (Proc. Zoöl. Soc., 1850, 54) mentions a *Bulimus alternatus* from Panama.

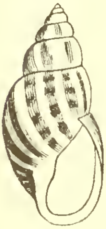
Plate LI. a, represent a variety of *B. dealbatus* (q. v.), as does also, I should judge, Fig. 2 of Plate LI.,[1] though the last may be *B. Schiedeanus*.

In Vol. IV. of Terrestrial Mollusks I took the same view of *Bul. alternatus* as at present, having the original figure of Mr. Say to assist in determining the species (Pl. LXXX. Fig. 3). I figured (Pl. LXXX. Fig. 1) a specimen on which a dark brown color is but slightly broken by white upon the upper whorls. Fig. 15 of the same plate should be also referred to *B. alternatus*. On account of the lesser development of the columellar fold I erroneously referred it to *B. Schiedeanus*. On p. 128 I repeated Pfeiffer's description of *Bulimus Mariæ*. I had seen no specimen, and admitted the species only temporarily, observing that it must be nearly allied, if not identical, with *B. alternatus*. Since that time I have received authentic specimens, and have learnt that *Bul. Mariæ* was described from specimens similar to those I have considered as *Bul. alternatus*. While preparing the fourth volume of the Terrestrial Mollusks for publication, I sent to Dr. Pfeiffer for identification specimens like those figured on Plate LI. b. He returned them with the name *B. Binneyanus*. This will account for the use of that name on p. 128. I have subsequently learnt that, deciding the specimens sent to be a variety of *B. Mariæ*, he applied the name *B. Binneyanus* to quite another species (Proc. Zoöl. Soc., 1858, Pl. XLII. Fig. 4).

Pfeiffer gives Say's description of *B. alternatus* as a species unknown to him. It is not mentioned by other authors.

Bulimus Mariæ, Albers, is referred to *alternatus* from the description, given below, of Albers and Pfeiffer,[2] from the figure in the second edition of Chemnitz, and from authentic specimens in my collection.

Fig. 273.



B. Mariæ.

Bulimus Mariæ. Shell perforate, ovate-pyramidal, striatulate, shining, white, varied irregularly with diaphanous bands and spaced blotches; whorls 6½, convex, joined by a deep suture, the last a little shorter than the spire; columella somewhat constricted, strongly tuberculate above; aperture oblong-oval, smoky within; peristome whitely labiate within, broadly expanded, its columellar margin reflexed, patent. Length 30, diameter 12 mill.; of aperture, length 12, interior breadth 7 mill. (Albers.)

Fig. 273 represents a common form of *Bulimus Mariæ*.[3]

Dr. Pfeiffer's description of *B. Mariæ* is as follows: —

Shell narrowly umbilicated, oblong-conic, solid, rather smooth, white, often marked with spots and obsolete blotches of horn-color; spire conic, acute; whorls 6½, rather convex, the last about as long as the spire, hardly attenuated at base; columella with a small dentiform fold; aperture scarcely oblique, acuminately oblong, brownish within; peristome straight, its right margin somewhat arched, its columellar margin broadened above, spreading. Length 33, diameter 14 – 15 mill.; of aperture, length 16 – 17, breadth 7½ mill.

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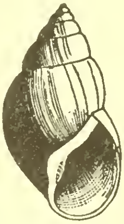
[1] In the explanation of the plates in Vol. III. Dr. Gould refers Plate LI. b, to *Bu Schiedeanus*, Pl. LI. a, to *lactarius*, and Fig. 2 of LI. to *alternatus*.

[2] Plate LI. b, of Terr. Moll. is referred by Pfeiffer to a form of *B. Mariæ*, Pl. LI. a, to *lactarius*, which he says may be *alternatus*, and Pl. LI. Fig. 2, to *Schiedeanus*.

[3] The figure being in outline is unshaded in the aperture, which in the original is dark brown.

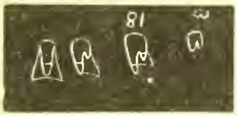
Fig. 274.



B. alternatus.

One of the uniformly white forms of the species is figured in Fig. 274, and two of the same from the table-land west of Fort Clark, figured in Fig. 272, show the variation in breadth of which the species is capable.

Fig. 275.



Lingual dentition of
B. alternatus.

Jaw as usual in the genus; numerous delicate ribs; a strong upper muscular attachment.

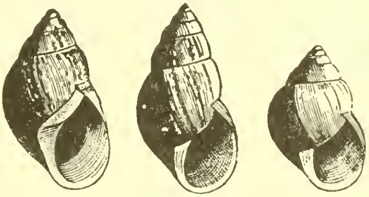
There are about 76 rows of teeth on the lingual membrane of *B. alternatus*, each consisting of 75 (37—1—37) teeth. Central teeth long, unicuspid, bluntly pointed, the laterals bicuspid, modified as they pass off laterally into the marginals.

Genitalia not observed.

Bulimulus Schiedeanus, Pfeiffer.

Shell perforated, ovate-acute, calcareous, white, with irregular longitudinal wrinkle-like striæ; whorls 6½, rather convex, the last as long as the spire; aperture oval-oblong, brownish within; columella obsoletely folded; peristome simple, acute, its margins joined with a shining callus, the columellar one broadly reflected, white and shining. Length 31, diameter 17 mill.; length of aperture 17, breadth 9 mill.

Fig. 276.



B. Schiedeanus.

Bulimus Schiedeanus, Pfeiffer, Symb. ad Hel. Hist., I. 43; Mon. Hel. Viv.,[1] II. 187; in Chemnitz, ed. 2, No. 216, Pl. XLVI. Figs. 3, 4 (1854). — Philippi, Icon., I. 3, p. 56, Pl. I. Fig. 12 (1843). — Reeve, Con. Icon., No. 361. — W. G. Binney, Terr. Moll., IV. 129; L. & Fr.-W. Sh., I. 204 (1869).
Bulimus alternatus, Binney, Terr. Moll., Pl. LI. Fig. 2. — Not of Say.
Thaumastus Schiedeanus, Tryon, Am. Journ. Conch., III. 172 (1867).

Texas and the neighboring part of Mexico. Very common in Washington County, Texas.

From *Bulimulus alternatus* this species is distinguished by a rougher surface, a light-colored aperture, a shorter and more pyramidal spire, and by the want of the highly developed tooth-like fold upon the columella. It is of a dead white color, not variegated with brown blotches. The aperture is shorter and wider, and there is no strong internal white thickening to the peritreme. Like all the species of the group it has a highly polished, very light waxen apex. There are sometimes light delicate waxen vittæ upon the first two whorls.

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[1] Pfeiffer quotes also as synonymes the manuscript names *B. xanthostomus*, Wiegm., and *B. candidissimus*, Nyst.

No description of this species was given by Dr. Binney, nor was it figured unless in Pl. LI. Fig. 2, as *B. dealbatus*, var. On p. 278 of Vol. II. Dr. Gould erroneously refers to it Pl. LI. b.

There is a great difference in the comparative globoseness of the various specimens.

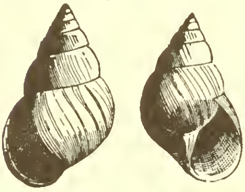
The shell figured as a variety of *B. Schiedeanus* with a dark-colored aperture in the fourth volume of the Terrestrial Mollusks (Pl. LXXX. Fig. 15) is rather a specimen of *Bul. alternatus*, in which the columellar fold is not as strongly developed as usual. Fig. 8 of the same plate I describe below as variety *Mooreanus*.

Lingual membrane as in *dealbatus*. Jaw with 13 ribs.

Variety **Mooreanus**.

Shell perforated, ovate-conic, thin, white, with a dark lead-colored apex, and below the middle of the body-whorl of a light coffee-color; smooth, with microscopic revolving lines; whorls 7, convex, the last equalling about two thirds the shell's length; aperture ovate, light within; columella straight; peristome acute, very thin, with an internal delicate white rim, its margins unconnected with callus, that of the columella broad, white, slightly reflected. Length, 25 mill.; breadth, 12 mill.

Fig. 277.



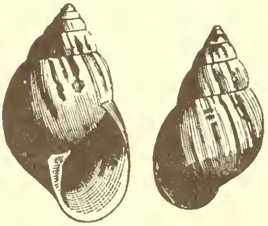
B. Mooreanus.

Bulimus Schiedeanus, var., W. G. BINNEY, Terr. Moll., IV. 129, Pl. LXXX. Fig. 8.

Bulimus Mooreanus, PFEIFFER, Mon., VI. 143 (1868).

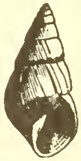
Found in large numbers in Washington and DeWitt Counties, Texas, by Dr. F. W. Moore, and at Leon by Lieutenant Beale.

Fig. 279.



B. Mooreanus.

Fig. 278.



B. Mooreanus.

It is a more fragile, highly polished shell than *B. Schiedeanus*, and is peculiar in having the dark apex and the body-whorl light coffee-colored below the upper margin of the aperture. In one case only have I observed the whole shell of this color; it was then of a darker hue. There is an extremely light, transparent callus on the parietal wall of the aperture.

To this variety also are to be referred specimens having delicate longitudinal light wax-colored patches. (Fig. 279.)

Animal not observed.

Bulimulus dealbatus, SAY.

Vol. III. Pl. LI. Fig. 1; Fig. LI. a, except upper and lower Figs.

Shell umbilicated, ovate-conical, or rather ventricose, thin, white, with longitudinal lines and blotches of ash; suture impressed; whorls 6 to 7, ventricose, acuminate, the last equalling the spire; aperture oval; peristome acute, rarely a little thickened within, somewhat reflected at its columellar portion, and partially hiding the umbilicus. Length of axis, 18 mill.; diameter, 12 mill.

Helix dealbata, SAY, Journ. Phila. Acad., II. 159 (1821); ed. BINNEY, 20.

Bulimus dealbatus, POTIEZ & MICHAUD, Galerie, I. 139, Pl. XIII. Figs. 3, 4. — PHILIPPI, Icon., I. p. 158, Pl. II. Fig. 6 (1844). — PFEIFFER, Mon. Hel. Viv., II. 187; in CHEMNITZ, ed. 2, p. 55. — REEVE, Con. Icon., Fig. 455. — BINNEY, Terr. Moll., II. 276, Pl. LI. Fig. 1; Pl. LI. a, excepting upper and lower Fig.? — W. G. BINNEY, Terr. Moll., IV. 130, Pl. LXXX. Figs. 6, 7; L. & Fr.-W. Sh., I. 208 (1869).

Bulimus confinis, REEVE, Con. Icon., 643 (1850). — PFEIFFER, Mon. Hel. Viv., III. 341.

Bulimus liquabilis, REEVE, Con. Icon., 387.

Bulimus lactarius, MENKE in PFEIFFER,[1] Mon., II. 187. — REEVE, Con. Icon., 217. — GOULD, Terr. Moll., III. 35.

Scutalus dealbatus, TRYON, Am. Journ. Conch., III. 173 (1867).

A species of the Interior and Southern Regions, found from North Carolina to Missouri, Arkansas, and Texas, also Henry and Lawrence Counties, Kentucky. Very common in Central Alabama, where immense beds of semi-fossilized shells are found, several feet below the surface.

This species, when found in Northern Alabama, is about three fourths of an inch in length, is quite thin, almost transparent, with a thin peristome. In more southern localities its size is greater, its shell thicker, its coloring richer, and within the aperture the peritreme is margined with a broad white callus. Under such circumstances it bears considerable resemblance to *B. alternatus*, but the interior of the aperture never has the dark coloring of that species, nor is the columella furnished with the tooth-like fold. It is especially in Texas that it is found in such perfection. I have no doubt that the specimens figured on Pl. LI. a, of the Terrestrial Mollusks came from that State.

It is this last-described form of the species which has been called *Bulimus lactarius*. I have seen no authentic specimen, but from Pfeiffer's description (see Terr. Moll., IV. 128), and his reference to all but the lower figure of Pl. LI. a (Mon., IV. 476), there remains no doubt of the identity of the two.

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[1] Pfeiffer quotes as synonyme the unpublished name of *Bulimus Galeottii*, NYST.

The variation in the globoseness of the whorls, and consequent outline of the shell, may be judged from the following measurements of two specimens: diameter 18, length 25 mill.; diameter 7, length 19 mill.

Of *Bulimus liquabilis* and *confinis* I have given the original description and a fac-simile of the original figures in the fourth volume of the Terrestrial Mollusks.

The jaw of *Bulimulus dealbatus* is narrow, strongly arched, with distant, very delicate anterior ribs, denticulating the concave margin. (See above, Fig. 269.)

The lingual membrane consists of 94 rows of teeth, 25—1—25 teeth. (See above, p. 387.)

The anatomy is figured by Leidy (l. c.). The penis sac is very long; its upper portion is narrow and very tortuous, and flagellate in appearance; although the true flagellum, or the free portion of the summit of the penis beyond the insertion of the retractor muscle, is very short. The lower third of the penis is dilated, and presents an annular constriction; at its base it is enveloped by a short prepuce. The vas deferens follows the course of the penis nearly to its summit. The genital bladder is oval; its duct as long as the oviduct.

Bulimulus serperastrus, SAY.

Vol. III. Pl. L. Fig. 2.

Shell elongate, ovate, even fusiform, thin, with delicate lines of increment, yellowish-white, with about 6 unequal, interrupted, sometimes coalescent, bluish-black bands on the large whorl, three of which are continued on the upper whorls; whorls 6 or 7, slightly convex, with a fine, well-marked suture; aperture less than half the length of the shell, lunate, one half longer than wide, rather acute at base; peristome sharp, expanded, its columellar portion widening upwards, and protecting a moderate-sized umbilical opening; columellar margin straight; the bands of the exterior reappear, in still deeper colors, in the fauces, but terminate at some distance short of the peristome, which is white, or tinted more or less rose-color. Length 31, diameter 13 mill.; aperture 15 mill. long, 8 wide.

Bulimus serperastrus, SAY, New Harmony Diss., Dec. 30, 1830; BINNEY'S ed., 39. — PFEIFFER, Mon. Hel. Viv., II. 102; III. 341; in CHEMNITZ, ed. 2, 82, Pl. XXX. Fig. 122; Pl. XXXIX. Fig. 5 (1854). — PHILIPPI, Icon., III. 23, p. 43, Tab. IX. Fig. 6 (1850). — REEVE, Con. Icon., No. 252. — BINNEY, Terr. Moll., II. 274, Pl. L. Fig. 2. — W. G. BINNEY, Terr. Moll., IV. 126; L. & Fr.-W. Sh., I. 192 (1869).

Bulimus Liebmanni, PFEIFFER, Mon. Hel. Viv., II. 106.

Bulimus Ziebmanni, REEVE, Con. Icon., 506.

Bulimus nitelinus, REEVE, Con. Icon., 398.

Drymœus serperastrus, TRYON, Am. Journ. Conch., III. 167 (1867).

This species belongs more to the fauna of Mexico and Central America than to that of the United States, but is admitted here because it has actually been found in Texas. It cannot, however, be considered a species of the Texan Subregion.

More slender and elongated individuals have been described under the names of *B. Liebmani* and *Ziebmanni.* The former name is withdrawn in the third volume of Pfeiffer's Monograph. An imperfect smaller specimen is described as *nitelinus.* I do not agree with Dr. Gould in also placing *B. lilacinus*, Rve., in the synonymy.

The specimen figured above is from Dr. Binney's collection. Fig. 335 of L. & Fr.-W. Shells, I., is copied from a drawing by Mrs. Say, under which is written in Mr. Say's handwriting, "*Bulimus serperastrus, Mexico, Mr. McClure.*" This places the identity of the species beyond any doubt.

In the collection of Mr. Bland is a uniformly white specimen.

Animal not observed.

Bulimulus multilineatus, SAY.

Vol. III. Pl. LVIII.

Shell subperforate, thin and strong, elongated, ovate-acuminate, smooth and shining, of a bright yellowish-white color, variegated with longitudinal stripes and spiral zones of dark chestnut, of various widths, none of which are constant, except a subsutural line, continued to the apex, which is also black; whorls about 7, a little convex; suture delicate; aperture rounded-ovate, a little more than one third the length of the shell; peristome acute; columella straight, widening upwards, and protecting a minute umbilical opening. Length, 25 mill.; diameter, 10 mill.

Bulimus multilineatus, SAY, Journ. Acad. Nat. Sci. Phila., V. 120 (1825); ed BINNEY, 28. — DEKAY, N. Y. Moll., 56 (1843). — W. G. BINNEY, Terr. Moll., IV. 132; L. & Fr.-W. Sh., I. 197 (1869). — PFEIFFER, Mon. Hel. Viv., II. 204.

Bulimus Menkei, GRUNER, Wiegm. Archiv., 1841, I. 277, Pl. XI. Fig. 2. — PFEIFFER, Mon. Hel. Viv., II. 176.

Bulimus venosus, REEVE, Con. Icon., Pl. XLV. Fig. 285 (1848).

Bulimus virgulatus, BINNEY, not FÉRUSSAC, Terr. Moll., II. 278, Pl. LVIII. — LEIDY, T. M. U. S., I. 259, Pl. XV. Figs. 7-8 (1851), anat. — PFEIFFER, l. c., IV.

Mesembrinus multilineatus, TRYON, Am. Journ. Conch., III. 169 (1867).

Key West and Lower Matacumba Key, in the Florida Subregion; St. Martha, Magdalena, and Bambo Bay, New Grenada; Maracaibo and Porto Cabello, Venezuela (cabinet of Mr. Swift). It evidently belongs to the fauna of New Grenada, and it is difficult to account for its presence in the Florida Subregion. (See p. 37.)

There is considerable confusion regarding the synonymy of this shell. An immature specimen from Florida was first described by Mr. Say as *Bulimus* *multilineatus.* It was not again met with until Dr. Binney received specimens from his collector in Florida. From these shells it was described and figured in the Terrestrial Mollusks. Its identity with Mr. Say's species was there recognized, but as *B. multilineatus* was considered a synonyme of the West Indian *Bulimus virgulatus*,[1] our shell was placed under that name. In the fourth volume of the Terrestrial Mollusks I restored to the species the original name of *multilineatus.* Among European authors the name is mentioned only by Pfeiffer (Mon., II. 204) as a species unknown to him, and later (IV. 482) as a synonyme of *Bul. elongatus.* The last quotation was probably influenced by the treatment of the species in the Terrestrial Mollusks, as he also quotes in the same synonymy the description and figure of that work. It appears to me that Dr. Pfeiffer has described the species from specimens from the Orinoco, under the name of *Bulimus Menkei.* While criticising the plates of the Terrestrial Mollusks (Mal. Blätt., 1859, p. 29) he notices the resemblance of the upper figure to *Bul. Menkei* in color.

The name *Bulimus venosus* of Reeve was suggested for the specimens from the banks of the Orinoco, on account of *Bulimus Menkeanus* of Férussac preventing the use of the name *Bul. Menkei.*

Specimens resembling those from Florida have been received from Venezuela by Mr. Swift. There can be no doubt of the species having several times been found in Florida as well as in South America.

I add below the descriptions of Say and Pfeiffer.

> *Bulimus multilineatus.* — Shell conic, not very obviously wrinkled ; whorls not very convex, yellowish-white, with transverse entire reddish-brown lines ; a blackish subsutural revolving line ; suture not deeply indented, lineolar ; apex blackish ; umbilicus small, surrounded by a broad blackish line ; columella whitish ; labrum simple, blackish. Length less than seven tenths of an inch ; greatest breadth less than seven twentieths of an inch. This species was found by Mr. Titian Peale on the southern part of East Florida. (Say.)
>
> *Bulimus Menkei.* — Shell subperforated, oblong-acute, thin, smooth, white, with three bands (two confluent, one sutural) and streaks of chestnut ; whorls 7, rather convex, the last about equalling two fifths the shell's length ; columella obliquely receding ; aperture oval-oblong ; peristome simple, acute, black, its columellar termination dilated, arcuately reflected, appressed. Length, 21 mill. ; diameter, 9 mill. ; aperture, 9 mill. long, 4½ wide. Near Orinoco, Venezuela. (Pfeiffer.)

A study of these descriptions will, I believe, convince one of the identity of the Florida and Orinoco shells with *Bulimus multilineatus.* There can be no doubt that the well-known *Bul. elongatus* is quite a distinct species.

Jaw and lingual dentition unknown.

Genitalia (see Leidy, l. c.). The penis sac is long, irregularly cylindroid, and has its base enclosed in a short prepuce; the vas deferens terminates in, and the retractor muscle is inserted into, its summit; the genital bladder is oval, its duct is not more than one third the length of the oviduct, and dilates as it passes downwards.

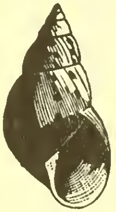
---

[1] This is now recognized as a synonyme of *B. elongatus*, Bolt.

Bulimulus Dormani, W. G. Binney.

Shell perforated, thin, transparent, shining, elongated-conic, of a very light waxen color, with several regular revolving series of interrupted, perpendicular, reddish-brown patches; suture distinctly marked; apex punctured; whorls 6, rather convex, marked with numerous very fine revolving lines; upper whorls striate, last whorl full, with a hardly perceptible obtuse carina at the upper extremity of the peristome. Length, 29 mill.; diameter, 12 mill.

Fig. 280.



B. Dormani.

Bulimus Dormani, W. G. Binney, Proc. Acad. Nat. Sci. Philad., 1857, 188; Terr. Moll., IV. 132, Pl. LXXX. Fig. 10; L. & Fr.-W. Sh., I. — Pfeiffer, Mal. Blätt., 1859, 45.

Liostracus Dormani, Tryon, Am. Journ. Conch., III. 169 (1867).

Florida Subregion. Found at several points, among them Hanson's, near St. Augustine, Florida, by O. M. Dorman; also at General Hernandez's plantation on the Matanzas River; Port Orange, Halifax River; from between Cedar Keys and Suwanee.

Judging from the description and figure given by Reeve, *Bulimus maculatus*, Lea, of Carthagena, New Grenada, must be nearly related to this species.

The original specimen from which my former description was drawn was thickened and of a chalky white, probably having been burned. I have recently received from Mr. Dorman fresh specimens which are very thin and of a waxen hue.

Animal of a dirty white; mantle banded as the shell. Usually found adhering to the under side of the leaves of palmetto, high above the ground.

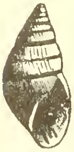
Jaw as usual in the subgenus, thin, transparent, slightly arcuate, wide, ends attenuated, blunt; anterior surface with about 54 distant, plait-like ribs, those of the upper median portion decidedly converging.

Lingual membrane (Pl. X. Fig. F) with about 79—1—79 teeth, of the form already noticed in *Bul. laticinctus*, *Bahamensis*, *aurisleporis*, *papyraceus*, *Jonasi*, *membranaceus*, etc., etc., but hitherto unnoticed in any North American species. The centrals have a base of attachment longer than wide, a stout, short, tricuspid reflection, each cusp bearing a distinct cutting point. Laterals with equilateral base of attachment, large irregularly tricuspid reflection; the cutting point is extremely wide, oblique, tricuspid, the central division the largest. The marginals differ only in smaller size, more elongated reflection, and instead of the single outer cutting point there are three or four, giving a serrated appearance. The lingual membrane is broad.

Genitalia (Pl. XV. Fig. J) without accessory organs. The penis sac is long, cylindrical, tapering into a flagellum above, and receiving the vas deferens near its lower termination. The genital bladder is ovate on a long duct.

Bulimulus Marielinus, Poey.

Fig. 281.



Bulimulus Marielinus.

Shell imperforate, ovate-conic, thin, very minutely substriate, somewhat shining, pellucid, white, varied above the middle by numerous subinterrupted, reddish-chestnut bands; spire conic, somewhat acute; whorls 5, scarcely convex, the last about equalling the spire, subattenuated at base; aperture scarcely oblique, subelliptical, narrowed at base; peristome simple, straight, its columellar termination subreflected above, appressed. Length 16, diameter 8 mill.; of aperture, length 9, breadth in its centre 5 mill.

Bulimus Marielinus, Poey, Memorias, I. 212, 447; II. Pl. XII. Figs. 32, 33 (young). — Pfeiffer, Mon. Hel. Viv., III. 407. — W. G. Binney, L. & Fr.-W. Sh., I. 193 (1869).

Bulimus (*Leptomerus*) *Marielinus*, Tryon, Am. Journ. Conch., III. 174 (1867).

A Cuban species, specimens of which were found by Dr. J. G. Cooper in the Florida Subregion in Southern Florida; one of them is drawn in Fig. 281. I have also received it from near the Miami River.

The shell is very thin. It may readily be distinguished from *B. Dormani.* It is more cylindrical in outline, its bands of color are revolving, not longitudinal.

Jaw short, broad, strongly arched above, moderately so below; ends attenuated, blunt; anterior surface with coarse longitudinal striæ, and with rib-like processes, scarcely elevated, but denticulating the cutting edge.

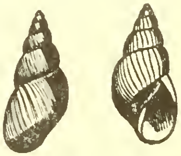
Lingual membrane not observed.

Genitalia not observed.

Bulimulus Floridanus, Pfeiffer.

Shell narrowly perforated, ovate-elongate, rather smooth, grayish-green, variegated with white opaque streaks and spots; spire elongate-conic, somewhat acute; whorls $6\frac{1}{2}$, rather convex, the upper ones banded with interrupted brown, the last about three sevenths the length of the shell, subangulated below the middle, attenuated at the base; columella somewhat twisted, receding; aperture slightly oblique, oval; peristome thin, its right termination narrowly expanded, the columellar termination dilated, reflected, hardly touching the shell. Length $15\frac{2}{3}-17$, diameter $7\frac{1}{2}$ mill.; length of aperture $7\frac{1}{2}$, diameter $4\frac{1}{2}$ mill.

Fig. 282.



B Floridanus.

Bulimus Floridanus, Pfeiffer, Proc. Zoöl. Soc., 1856, 330; Mon. Hel. Viv.,

IV. 406. — W. G. BINNEY, Terr. Moll., IV. 134, Pl. LXXIX. Fig. 3; L. & Fr.-W. Sh., I. 194, Fig. 338 (1869), not of CONRAD.

Liostracus Floridanus, TRYON, Am. Journ. Conch., III. 168 (1867).

Florida, in the Florida Subregion.

The specific name must not be confounded with that proposed by Conrad for a fossil species (Sill. Am. Jour. [2], II. 399).

I have not seen this species. Fig. 282 is copied from drawings of the original specimen in Mr. Cuming's collection.

Animal not observed.

SPURIOUS SPECIES OF BULIMULUS, ETC.

Bulimus radiatus, LAMARCK, is attributed to the Western prairies in WHEATLEY'S Catalogue of U. S. Shells, 21.

Bulimus neglectus, PFR., has been erroneously referred to Texas (MART. & ALB., Helic., 188). — PFEIFFER, II. 113, says Brazil; in VI. 55, he says Texas on authority of ALB., ed. 2.

Bulimus acutus, MÜLLER, is quoted, without description, from N. A. by FORBES, (Br. Ass. Rep., 1840, 145). See also Bost. Journ. Nat. Hist., III. 409.

Bulimus octona, BRUG., has been found in greenhouses and gardens, where it has been introduced on plants. It is a *Stenogyra*.

Bulimus exiguus, BINN., is the same as *Carychium exiguum*.

Bulimus fasciatus, BINN., is the same as *Liguus fasciatus*.

Bulimus Gossei, PFR., vid. *Macroceramus*.

Bulimus Kieneri, PFR., vid. *Macroceramus Kieneri*.

Bulimus lubricus, AD., etc., is the same as *Ferussacia subcylindrica*.

Bulimus obscurus, DR., vid. *Pupa placida*, SAY.

Bulimus striatus, BRUG., is the same as *Glandina truncata*.

Bulimus vexillum, BRUG., is the same as *Liguus fasciatus*.

Bulimus vermetus, ANTHONY, is unknown to me. He thus describes it (Cover of Haldeman's Monograph, No. 3, July, 1841): Shell turriculated, livid brown; whorls 5, striated longitudinally; suture deeply indented; apex entire; body whorl a little more than equal to the spire; spire two and a half times the length of the aperture; length 3, width 1½ lines; aperture obliquely ovate; length of the aperture equal to the width of the body whorl. Ohio, near Cincinnati.

Distinguished by its peculiar mouth, which is curved in a regular curve from right to left, contracted at the upper angle, and spreading below; the whorls are also very deeply indented, and twisted as they are in *Succinea vermeta*.

Bulimus Mexicanus, LAMARCK, and

Bulimus Humboldti, REEVE, have been doubtfully referred to Mazatlan.

Bulimus Laurentii, SOWERBY, Sitka, is, I presume, from Sitcha, San Salvador, not from the northwest coast (see Terr. Moll. U. S., IV. 25).

Bulimus acicula, MULL., T. M., IV. 137, vide *Cœcilianella acicula*.

Bulimus marginatus, W. G. BINN., = *Pupa fallax*.

Bulimus modicus, W. G. BINN., = *Pupa modica*.

Bulimus chordatus, PFR., = *Pupa chordata*.

Bulimus decollatus and *B. mutilatus*, SAY, = *Stenogyra decollata.*

Bulimus subulus, W. G. BINN., = *Stenogyra octonoides.*

Bulimus gracillimus, W. G. BINN., = *Stenogyra gracillima.*

Bulimus harpa, BINN., = *Acanthinula harpa.*

Bulimus carinatus, BRUG., Encycl. Méth., I. 301 (1792); Bosc., IV. 89 (*Buccinum*, LISTER & PETIVER), is an exotic Melanian, not inhabiting Virginia.

Bulimus urceus, BRUG., Encycl. Méth., I. 298 (1792), from Mississippi River, = *Ampullaria.*

Melania striata, PERRY, Conch., Pl XXIX. Fig. 5, "New California," is *Bulimus melania*, FÉRUSSAC.

Bulimus Berlandierianus, BINN., in Am. Journ. Conch., 1865. Amer. bor., PFR., Mon., VI. 153 (1868), probably confounding the Limnæan *Bulinus.*

Bulimulus Californicus, REEVE. Shell somewhat acuminately ovate, rather thin, scarcely umbilicated; whorls 6 in number, smooth; columella reflected, lip simple; cream-color, encircled with interrupted transverse blue-black zones (*Reeve*, Con. Icon., 378). Is not a California species, but probably Mexican. See L. & Fr.-W. Sh., I. 199.

Columna Californica, PFEIFFER. Shell subulate, thin, with very crowded, oblique striæ or wrinkles, waxen white; whorls 12 to 13, the upper convex, the last three or four flat, the last exceeding slightly one sixth the shell's length, sharply carinated at base, below the carina somewhat hollowed out; columella arched, thickened, subtruncated, reaching the base; aperture somewhat four-sided; peristome simple, acute. Length 23, diameter 3½ mill.; aperture, 4 mill. long, 2¼ wide.

Achatina Californica, PFEIFFER, Symb. ad. Hist. Hel., III. 89; Mon. Hel. Viv., II. 267. — REEVE, Con. Icon., 115. — W. G. BINNEY, Terr. Moll., IV. 26, Pl. LXXIX. Fig. 19; L. & Fr. W. Sh., I. 190. — BLAND, Ann. N. Y. Lyc., VIII. 166, Fig. 10 (1865).

Columna Californica, CHENU, Man. de Conch., I. 431, Fig. 3172.

Referred to Monterey, California, but certainly not found there. I have given a copy of Reeve's figure, and a figure of a specimen from Bogota, New Grenada, which seems identical with it in L. & Fr.-W. Shells, I. The species is a *Rhodea.*

FOSSIL SPECIES OF COLUMNA.

Columna ? teres, MEEK & HAYDEN, Proc. Acad. Nat. Sci. Philad., 1860, 431 (= *Bul. ? teres*), *Clausilia ?* M. & H., l. c., 1856, 117.

Columna ? vermiculus (*Clausilia ?*) MEEK & HAYDEN, Proc. Acad. Nat. Sci. Philad., 1860, 431 (= *Bul ? vermiculus*), M. & H., l. c., 1856, 118.

FOSSIL SPECIES OF BULIMULUS, ETC.

Bulimus limneiformis, MEEK & HAYDEN, Proc. Acad. Nat. Sci. Philad., 1860, 431 = *B. Nebrascensis*, l. c.

Bulimus Floridanus, CONRAD, Sill. Am. Journ. Sc. [2], II. 399.

Bulimus perversus, MEEK & HAYDEN, = *Clausilia contraria*, M. & H.

Doubtful Species of Achatina.

Liguus Virgineus, Montfort, Conch. Syst., II. 423, Louisiana. (*A. Virgineus*, Jay, Wheatley. *Bulimus vexillum*, DeKay.) The species is from Haiti.
Achatina lubrica, Binney. See *Ferussacia subcylindrica.*
Achatina bullata, Pfr. See *Glandina.*
Achatina truncata, Pfr. See *Glandina.*
Achatina Vanuxemensis, Lea. See *Glandina.*
Achatina rosea, Deshayes. See *Glandina truncata.*
Achatina striata, DeKay, is *Glandina truncata.* See Terr. Moll., IV. 139.
Achatina subula, Pfr. See *Stenogyra.*
Achatina Texasiana, Pfr. See *Glandina.*
Achatina australis, Villa, N. Am., Disp., 19. Unknown to me.
Achatina pellucida, Pfr. See *Blauneria.* See Vol. IV.
Achatina gracillima, Pfr. See *Stenogyra.*
Achatina flammigera, Say (ed. Binney, 29) = *Orthalicus undatus.*
Achatina flammigera, Férussac. See Vol. IV. 138.
Achatina mucronata, etc., etc., Maine, Ravenel's Cat., 1874, 44, is a typographical error for *Achatinella mucronata* of Maui.
Achatina ——, Baffin's Bay. See Mörch, Am. Journ. Conch., IV. 38.

D. GONIOGNATHA.

Jaw in separate pieces, the upper median one usually triangular; marginal teeth quadrate.

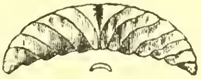
LIGUUS, Montf.

Animal heliciform, obtuse before, long and pointed behind; mantle subcentral, protected by a shell; other characters as in *Orthalicus*, *q. v.*

Shell imperforate, solid, elongate-conic, apex acuminated, variously fasciated; whorls 7–8, the last equalling about one third the shell's length; columella constricted, distinctly truncate in adult individuals; aperture lunate-oval, subangulated; peristome straight, acute, its margins joined by an entering callus.

But very few species of this genus are known, restricted to Cuba and Haiti. One of them has, however, been quoted from Guiana, and another has become naturalized in our Florida Subregion, having been introduced into the southern extremity of the peninsula.

Fig. 283.



Jaw of *L. virgineus.*

Jaw thick, arcuate, ends rapidly attenuated, pointed; composite, being in numerous, separate, free, imbricated, triangular pieces, with sutures inclined obliquely to the centre of the jaw, so as to leave an upper median, angular piece; other pieces are soldered together above. Cutting edge with no median projection, serrated by the lower angles of the oblique pieces. For more detailed description see below, under *Orthalicus*, which has a similar jaw. I am not able to give a figure of the jaw of the only species found within our limits, *L. fasciatus.* I is, however, figured by Leidy (Vol. I. Pl. V. Fig. 4, *a*, *b*). It is similar to that of the allied species *L. virgineus*, which is figured here on last page.

The only species found within our limits, *L. fasciatus*, has about 69—1—69 teeth, judging from a lingual membrane examined by me. That figured in L. and Fr.-W. Sh., I. p. 214, has 94 rows of 55—1—55 teeth each. As elsewhere stated, there is often a difference in the number of transverse teeth in almost all species, and indeed upon different parts of the same membrane. The membrane is shaped like that of *Orthalicus*. (See Pl. XVI. Fig. M.)

The central tooth (Pl. X. Fig. G) has a base of attachment long and narrow, with strongly incurved sides, widely expanded, excurved and fringed lower margin, and upper margin less expanded, rounded, and broadly reflected. The reflection is stout, and very rapidly narrows, without any appearance of side cusps, into a very broad, long, bluntly rounded median cusp, bearing a still broader, short, bluntly truncated cutting edge (as such a blunt organ cannot be called a point) reaching nearly to the lower edge of the base of attachment. It may be that I have here incorrectly considered the upper margin of the base of attachment as reflected and extended into the cusp. As in the case of the side teeth, I should, perhaps, rather say that the upper margin is not reflected, but that just below the middle of the base of attachment there springs up from its surface a broad, gouge-shaped cusp, bearing a still broader cutting edge (see *d*, where the form of the cusp of the side teeth is shown by the profile). The side teeth run rapidly and obliquely backward from the central tooth, thus giving a chevron-like arrangement to the membrane. The teeth are crowded together both longitudinally and transversely, excepting as they approach the outer edges of the membrane, where they are much more separated.

I have used the term side teeth instead of lateral and marginal teeth, because it is difficult to decide which of these types they properly are. Taking into consideration the fact of there being distinct lateral teeth in the allied species, *L. virgineus*, and that the marginals of that species resemble the side teeth of *L. fasciatus*, I am inclined to believe we should consider all the side teeth of *fasciatus* as marginals. In this case we must consider that the lateral teeth are entirely suppressed. The marginals, as I have decided to call them, are of the same type as the centrals. The base of attachment is, however, asymmetrical by the suppression of both upper and lower inner lateral expansion; the upper margin is simply squarely truncated. Above the centre of the base of attachment springs from its surface the gouge-shaped, rounded, gradually expanding cusp, reaching nearly the lower margin of the base of attachment, and produced into a still more expanded, bluntly truncated cutting edge (one cannot call it a cutting point), which projects far beyond the lower margin of the base of attachment on to the teeth of the next transverse row, and is also greatly expanded on the outer side, so as to overlap the adjoining tooth. This cutting edge is slightly incurved at its centre. There is one point of difference between the central and adjoining marginal teeth which is very marked; in the centrals the lower margin of the base of attachment is more expanded than the cutting edge, the reverse of which is found in the marginals.

The marginals retain this general form to the extreme edge of the membrane, but they decrease greatly in size upon the edge. The outer marginals have to their cusps a small side spur, gouge-shaped as the cusp itself; the extreme marginals have such a spur at either side. In both cases the cutting edge springs from the outer side of this side spur, which must be considered as representing the side cusps of the usual *Helicea* type of dentition. I have elsewhere (Ann. Lyc. N. H. of N. Y., XI. 39) shown that this type of tooth is but a modification of the usual type brought about by the expansion, bluntly rounding and shortening of the cusps, and the still greater expansion, bluntly rounding and shortening of the cutting points, which are quite changed into wide cutting edges.

I have given on Pl. X. Fig. G, a group of central and marginal teeth in *a*, an outer marginal in *c*, a marginal in profile in *d*.

The allied species *L. virgineus* differs from *fasciatus* in having a long blunt cutting point to its central tooth, and by the presence of several true lateral teeth with long cutting points, also in the presence of several teeth showing a gradual change from the laterals to the marginals. A full description and detailed figures of its dentition are given by me in Ann. Lyc. Nat. Hist. N. Y., XI. 41, Pl. III.

Liguus is nearly allied in its lingual dentition to *Orthalicus*, but in that genus also I have found one species with true lateral teeth, as will be shown below.

Liguus fasciatus, MÜLLER.

Vol. III. Pls. LV., LVI., LVII.

Shell imperforate, conical, rather thick, smooth, shining, minutely striated; whorls 7 to 8, convex, decreasing in diameter gradually and regularly from the body-whorl to the apex; suture impressed; apex obtuse, commonly white, sometimes rosy; aperture suboval, purely white internally, sometimes with a thickened ridge within, and parallel to the peristome; peristome acute, sometimes crenate; columellar margin with a thin callus, sometimes rosy; columella subtruncate in the young, entire in the mature shell, imperforate; surface beautifully variegated with broad, entire or interrupted bands, lines, and spots of brown, with bands and lines of green and yellow, and with lines of rufous, revolving upon the whorls from the apex to the aperture, but more distinct upon the outer whorls; a single system of coloring prevails in some shells, while in others there is a mingling of all of them upon the same specimen. Extreme length, 53 mill.; diameter, 23 mill.

Buccinum fasciatum, MÜLLER, Verm., II. 145 (1774).

Bulla fasciata, CHEMNITZ, Conch., IX. Tab. CVII. Figs. 1004 – 1006.

Bulimus vexillum, BRUGUIERES, Encycl. Méth., No. 107.

Helix vexillum, FÉRUSSAC, Hist., Pl. CXXI.

Achatina vexillum, LAMARCK, An. s. Vert., 2d ed., VIII. 298. — Not of DEKAY.

Achatina crenata, SWAINSON, Illust., Pl. LVIII.

Achatina pallida, SWAINSON, Ill., Pl. XLI.

Achatina fasciata, SWAINSON, Ill., Pl. CLXII. — REEVE, Conch. Syst. II., Fig. 12. — D'ORBIGNY, Moll. Cub., I. 172, Pl. VI. Figs. 1 – 7. — PFEIFFER, Mon. Hel. Viv., II. 245. — W. G. BINNEY, Terr. Moll., IV. 138; L. & Fr.-W. Sh., I. 213 (1869).

Achatina solida, SAY, Journ. Phil. Acad., V. 122 (1825); ed. BINNEY, 29. — DEKAY, N. Y. Moll., 56 (1843). — PFEIFFER, Mon. Hel. Viv., II. 246.

Agatina variegata, RAFINESQUE, Enum. and Acc., 3 (1831); ed. BINNEY and TRYON, 68.

Bulimus fasciatus, BINNEY, Terr. Moll., II. 266, Pl. LV., LVI., LVII. — LEIDY, T. M. U. S., I. 252, Pl. V. (1851), anat.

Liguus fasciata, TRYON, Am. Journ. Conch., III. 165 (1867).

Liguus picta, TRYON, l. c., 165, 4 (1867).

LISTER, Icon., l. c., Tab. XII. Fig. 7. — GUALT, l. c., Tab. VI. Figs. C, D. — D'ARGENVILLE, l. c., Pl. XI. Fig. M.

Miami River, southern part of Florida and islands and keys adjacent to the coast; Key West to Key Biscayne. Probably introduced from Cuba.

Animal dark brown or chocolate color over the whole body; surface very prominently granulated; eye-peduncles very long when extended, thick at their base, ocular points black and small; tentacles long, conical, rounded at the extremities; collar lead-color; extremity of foot usually rounded; when in motion, the whole foot glides smoothly forward, without any perceptible alternate motion of the margins; no distinct locomotive disk.

This species inhabits trees, upon the branches of which it is found. In winter it hibernates by attaching its aperture very strongly to the bark of the tree, by means of a thick, viscid, opaque secretion, which hardens to the consistency of glue. In tearing it away, the bark or the shell is fractured sooner than this secretion. At other times, when the animal withdraws into the shell, it secretes only a thin, transparent epiphragm.

This is one of the species evidently due to the geographical proximity of their locality to the island of Cuba. It occupies only the extreme end of the peninsula, and the nearest islands, whose shores are washed by the Gulf Stream, which has already swept by the northern coast of Cuba. Many of the varieties of coloring and marking common to Cuban specimens may be noticed among the Florida shells; but there is one well-defined variety, which, so far as we know, is peculiar to Florida. This variety is longer and less ventricose than the others, and its aperture is less ample. Upon a ground of pure white it is marked upon the body-whorl, and above and below the sutures, with broad, ill-defined, pale yellow bands. The apex and aperture are always white. The yellow bands are sometimes confluent or nearly so, and the yellow color appears to be diffused over the whole surface; more rarely the shell is entirely white. The columella is only slightly folded, and the lip is not crenate. The shell is somewhat thick. The variety is constant; and Mr. Say, supposing it to be a distinct species, called it *Achatina solida*, from the last-named character. (Pl. LV.)

There are two other varieties, existing also in Cuban specimens, which are well marked. The first (Pl. LVII.) is distinguished by grass-green lines, more or less numerous, and of greater or less diameter, and by narrow bands of the same color, revolving upon a white ground. They are more numerous and more distinct upon the body-whorl, and become almost obliterated on the posterior whorls; they are often undulating, and differ in the intensity of the color. The peristome, at the points where the lines terminate, is crenate or notched, which peculiarity has suggested one of the synonymes of the species. The axis is usually shorter than in the preceding variety; and, consequently, the body-whorl and aperture are larger in proportion to the whole magnitude of the shell; the columella is also more folded and thickened. The aperture is white. The other variety is marked by broad, entire or interrupted bands or blotches of deep brown. (Pl. LVI.) These sometimes cover nearly the whole surface; at other times they are broken into irregular spots, which are arranged above and below the sutures. The apex and the columellar margin are rosy; and so closely connected are these two characters with the presence of the brown color on the surface, that if a single spot or line of it is seen externally, the columellar margin will be pretty certainly found to be rosy. The columella is more prominently folded and thickened than in either of the other varieties.

Well-characterized specimens of these three varieties differ so much from each other that they might well be considered to be specifically distinct; but the passage from one to the other may be readily detected in some specimens. We see some retaining the wide yellow bands, amidst which are numerous, fine, green lines; this shows the connection of the two first-named varieties, but such specimens are comparatively rare. On the other hand, specimens are much more common exhibiting the broad brown bands or blotches upon the superior part of the spire, while the last, and perhaps the penultimate, whorls are marked with green lines alone.

The columella is sometimes prominently plaited and thickened; and the peristome joins it at an obtuse angle, but it is never truly truncated. In young shells there is a more near approach to a truncation; and a distinct angle or carina may be noticed on the body-whorl.

Jaw and lingual dentition (see p. 401, 402).

The genitalia are figured by Leidy (l. c.). The penis sac is long, cylindrical, and strongly muscular; the vas deferens joins it near the summit, and the retractor muscle, which is very long, is inserted into the latter; the oviduct is long, and its central part presents the peculiarity of being colored brown; the genital bladder is ovate, situated near the ovary, and its duct is narrow, and as long as the oviduct; the vagina is broad and muscular; at the base of the penis there opens a short, cylindrical duct, derived from a single multifid vesicle, which presents six or seven rounded or ovate divisions; there is no dart sac.

ORTHALICUS, Beck.

Animal (see below).

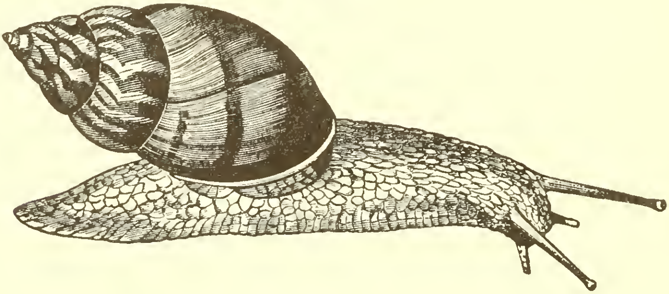
Shell imperforate, ovate or oblong, ornamented with often articulated fillets; apex obtuse, last whorl inflated; columella uniformly thickened, sometimes callous, arcuate, obliquely subtruncate at base; aperture longitudinal, oval.

The genus *Orthalicus* does not properly belong to the fauna of North America, but rather to that of tropical America, from whence specimens have been introduced to the Florida mainland and keys, and Jamaica. In what manner it was introduced it is difficult to say (see p. 36).

Subgenus ORTHALICUS, Beck, s. str.

Animal heliciform, large, scarcely included in the shell, long and obtuse before, rapidly attenuated behind; mantle posterior, slightly overlapping the peristome of the shell, and bilobed; respiratory and anal orifices under the peristome; orifice of generative organs behind the right eye-peduncle; no caudal mucus pore, no locomotive disk.

Fig. 284.

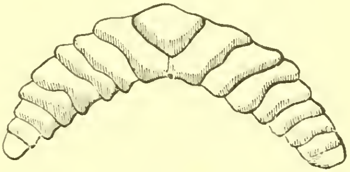


Animal of *O. undatus*.

Shell imperforate, ovate or oblong-conic, thin, striated, decussated with curling lines, and ornamented with usually articulated fillets and oblique swaths; whorls 6 – 8, the last inflated; columella filiform, loosely arcuated-intorted, obliquely subtruncated at base; aperture oval; peristome straight, its margins connected by a light callus.

The jaw of the only species within our limits, *O. undatus*, Brug. (see Fig. 285) is of the type usual in this genus and *Liguus* (see Fig. 283), but up to the present time never observed in any other genus. It is composite, its separate pieces being apparently soldered firmly at their upper portions, where, indeed, they seem collectively to form a jaw in a single piece, as in *Patula*, etc., but at their lower portion positively detached and free, imbricated one upon another. The jaw may in one sense be said to be in a single piece, as argued recently by Messrs. Fischer and Crosse (Moll. Mex. et Guat.), but with equal correctness it may surely be said to be composite, as the amalgamation of the upper portion is produced by the joining of absolutely separate pieces. There are seventeen of these plates in the jaw figured, though the number varies, the upper central one apparently lying upon the adjoining ones, which are broad and extend from the upper to the lower margin of the jaw. The jaw is strongly arched, with attenuated, blunt ends. There are well-marked perpendicular grooves upon the anterior surface of many of the plates. The upper central plate is triangular, from which fact the name *Goniognatha* has been applied to the section. *Cylindrella*, *Macroceramus*, *Pineria*, *Partula*, and some species of *Bulimulus* also have an upper median triangular compartment to their jaw, but in their case the jaw is in one single piece, with distant, delicate ribs, running obliquely to the central line, some of the upper ones meeting before reaching the lower margin of the jaw, thus leaving a triangular space not a separate piece.

Fig. 285.



Jaw of *O. undatus*.

I have myself figured the jaw of *O. melanochilus*, Val., under the name of *O. zebra* (L. and Fr.-W. Shells N. A., I. p. 215, Fig. 367), of *gallina-sultana* (Ann. N. Y. Lyc. Nat. Hist., XI. Pl. IV. Fig. E). The last-named has also been figured by Troschel (Arch. für Nat., 1849, Pl. IV. Fig. 3); the jaw of *O. iostomus* is figured by Crosse and Fischer (Moll. Mex. et. Guat., Pl. XIX. Fig. 8), and *O. longus* by the same authors (I. c, Pl. XIX. Fig. 1). I have also examined the jaw of *O. obductus*, Shuttl. (Ann. Lyc. N. H. of N. Y., XI. p. 37). All these species have the same composite type of jaw.

The lingual dentition of *Orthalicus undatus* is so nearly similar to that of *Liguus fasciatus*, that I merely compare it with the description given above of that species. The membrane is broad (see Pl. XVI. Fig. M). In *O. undatus* the central tooth (Pl. X. Fig. H) is broader in proportion to its length; the base of attachment is less expanded at the upper margin, and very much less so at its lower margin, and the sides are not incurved; the cusp is stouter, longer, reaching the lower edge of the base of attachment, and it has subobsolete but distinctly marked side cusps; the cutting edge is much more expanded, overlapping the next row of teeth. The first marginals differ from those of *L. fasciatus* in having a less developed cutting edge, the outer marginals have the side spurs to their cusps much more developed, and even the cutting edge is trilobed. The extreme marginals are not so small. There are about 53—1—53 teeth on one part of one membrane; a wide part of another membrane had 106—1—106.

All the species of *Orthalicus* enumerated above whose dentition is known have the same type of teeth as *O. undatus*, excepting *O. gallina-sultana*. This last (see Ann. Lyc. N. H. of N. Y., XI. 38, Pl. IV. Fig. A) is peculiar in having a long, stout cutting point with subobsolete side points to its central tooth, and three lateral teeth of same form but asymmetrical. Thus in both *Liguus* and *Orthalicus* we find the usual type of dentition is not constant excepting as to the marginal teeth.

I have also examined the form figured in Vol. IV. Pl. LXXVIII. Fig. 12, and copied in L. and Fr.-W. Shells N. A., I. p. 216, Fig. 370 (not Fig. 371, which is referred by Fischer and Crosse to *O. melanochilus*, Val.). It is probably a variety of *undatus*, not *O. zebra*, as I at first believed. The jaw has 7—1—7 separate pieces. The lingual membrane has 126—1—126 teeth. The teeth are of same type as in *O. undatus*, but the cutting edge of the centrals and first laterals is shorter than the base of attachment.

Orthalicus undatus, Brug.

Vol. III. Pl. LIV.

Shell imperforate, subconical, rather thick, smooth; incremental striæ fine, whitish, with longitudinal, irregular, undulating or somewhat zigzag, dark brown bands and clouds, intersected by straight, revolving lines of the same color; the body-whorl often with one or more straight, brown lines, at irregular intervals, indicating the former margins of the aperture; spire conic, apex obtuse; whorls 6 to 7, diminishing in diameter rapidly; body-whorl capacious, occupying two thirds of the whole length of the shell; aperture ample, ovate, showing the external colors within; peristome simple, acute, bordered with dark brown, or black, both internally and externally; parietal wall with a thin, shining, brownish, entering callus; columella slightly thickened, not reflected, nor truncate, making a continuous curve with the peristome. Common length of axis about 50 mill.; diameter of large whorl rather more than 25 mill.

(Bulla) Zebra Mulleri, Chemnitz, IX. Pt. 2, p. 24, Pl. CXVIII. Figs. 1815, 1816.

Helix (Cochlostyla) undata, Férussac, Tab. Syst., p. 32, No. 337; Hist., Pl. CXV. Figs. 1, 4; Pl. CXIV. Figs. 5, 6.

Bulimus (O.) undatus, D'Orbigny, Cuba, I. 174, Pl. VI. Figs. 9, 10.

Bulimus zebra, Binney, Terr. Moll., II. 271, Pl. LIV. (= Férussaci, Mart. teste, Fischer and Crosse). — W. G. Binney, Terr. Moll., IV. Pl. LXXVII. Fig. 13? — Pfeiffer, Mon. Hel. Viv., II. 143.

Orthalicus undatus, Shuttleworth, Not., 63, Pl. III. Figs. 4, 5. — Pfeiffer, Mon. Hel. Viv., IV. 589. — Tryon, Amer. Journ. Conch., III. 166? — W. G. Binney, L. & Fr.-W. Sh., I. 217 (1869).

Bulimus zebra, W. G. Binney, Terr. Moll., IV. Pl. LXXVIII. Fig. 12. — Var. Reeve, Con. Icon., Pl. XXVII. Fig. 90 b?

Orthalicus zebra, Fischer and Crosse, Moll. Mex. et Guat., 441, Pl. XVIII. Figs. 8, 8 a.

Bulimus reses, SAY, New Harm. Diss., Dec. 30, 1830; BINNEY'S ed., p. 39.
Agatina fuscata, RAFINESQUE, Enum. and Acc., p. 3 (1831); BINNEY'S and TRYON'S complete edition, 68.

Animal thick and massive, dirty or yellowish white, darker on the middle of the back; surface rugose, with prominent, oblong glands, and deep furrows. Whole length, exclusive of eye-peduncles, three inches. Eye-peduncles, when fully extended, one inch long, bulbous, with small, black, ocular points; tentacles one fifth of an inch long, slender. Orifice of generation behind the eye-peduncle on the right side. Mantle somewhat bilobed, protruding beyond the aperture, and slightly reflected. Posterior extremity rounded, sides corrugated, lower surface smooth, squalid. Eggs moderate, oblong-subrotund, with a granulately roughened, thick, calcareous covering.

Found in Jamaica and Cuba, and at Key West; also in Mexico. The specimens figured in the Terrestrial Mollusks were received from the southern part of the peninsula of Florida, in the Miami country, and from Key West to Key Biscayne. It has been referred also to Louisiana and Texas, but I have never heard of its presence there being well authenticated. It is difficult to explain its distribution except by supposing it to have been a widely distributed species of some extinct fauna which has survived at various points around the Gulf of Mexico.

This species inhabits trees. It attaches itself to the tree during hibernation, and covers its aperture by an opaque, inspissated, glutinous secretion, which, though exposed to wind and rain, forms a perfect adhesion and protection to the animal, and only yields to its own solvent powers on the approach of spring. It exists in great numbers; and the dead shells are a favorite habitation of a species of hermit crab.

The figure of the animal of *Orthalicus*, given on p. 406, is reduced from a drawing prepared for the Terrestrial Mollusks, but not there figured. On Pl. LXXVII., Fig. 13, of Vol. IV. I have given another view of the same shell, also prepared for publication in the Terrestrial Mollusks. I am not certain from what locality the shell was received, but from the fact of Dr. Binney describing in his work no shells but what he knew to exist in the United States, I am inclined to believe he received it from Florida. His collector would be more likely to furnish him with a living specimen from that point, than he to receive it from some Mexican or South American locality. I do not know to which species it may be referred, but presume it to be *B. undatus*. He thus describes it:—

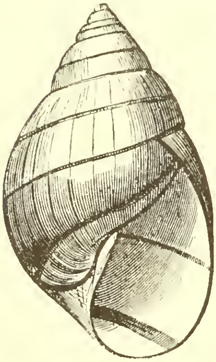
"The most beautiful form of the species is that figured in Pl. LIV. a. It is quite thick and ponderous; its general color is deep brownish, variegated with undulating intervals of white on the spire, and others more obscure on the columellar side of the body-whorl. On the side opposite to the aperture, the brown color is relieved only by three indistinct and ill-defined dark bands, and by the black line showing the margin of a former peristome. The columella is considerably thickened and folded, the columellar margin is covered by a black callus, and the peristome is broadly margined internally with black; further in, the aperture is purely white."

Mr. Say no doubt referred to *O. undatus* under the name of *Achatina flammigera*, Fér. (ed. Binney, p. 29). He mentions also the manuscript name of *reses*, which he had intended to give to a shell found on trees at the southern extremity of East Florida, but which he afterwards found to be *Bulimus undatus*, Brug.

Rafinesque's description of *Agatina fuscata* will be found on p. 50 of Vol I. The locality (Louisiana) is doubtful.

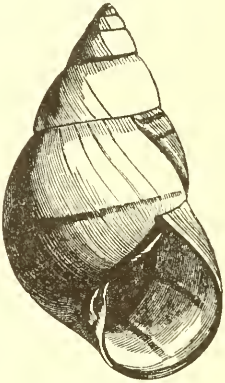
The specimen figured (Fig. 286) was collected at Key Biscayne, Florida. It is also found at Key West. Formerly I was inclined to refer it to *O. zebra*, and considered it as identical with specimens from the Sierra Madre, Mexico, which Messrs. Fischer and Crosse consider *O. melanochilus*, Val. (I figure one of this species in Fig. 287), but am now persuaded that it is simply a variety of *O. undatus*. Its genitalia agrees with those of *O. undatus*, as well as its jaw and lingual dentition (see ante, p.).

Fig 286.



O. Undatus, var.

Fig. 287.



O. melanochilus.

For jaw and lingual dentition see above, pp. 407, 408; Fig. 285 and Pl. X. Fig. H.

It will be interesting, in connection with my comparison of *Orthalicus* and *Liguus*, to state that, having had an opportunity of dissecting six specimens of this species from Jamaica, I found the genitalia constantly agreeing with Lehmann's figure in Malak. Blätt., 1864, Pl. I. Fig. 4. There is no multifid vesicle on the penis, as in the species of *Orthalicus* figured by Fischer and Crosse (Moll. Mex.). With this exception, the genitalia are quite like those figured by Leidy for *Liguus fasciatus* (Vol. I. Pl. V.).

It will be seen (Ann. Lyc. Nat. Hist. of N. Y., XI. 38) that *Orthalicus gallina-sultana* is also characterized by the want of the multifid vesicle. This organ cannot, therefore, be considered a generic characteristic.

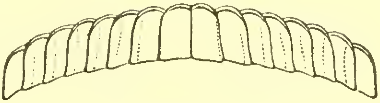
PUNCTUM, MORSE.

Animal heliciform, as in *Patula*, etc.

Shell bearing the usual characters of *Zonites* (see p. 98), from which it is generically separated by the nature of the jaw and lingual dentition. For geographical distribution see below, p. 412.

But one species of this genus has been described, *P. pygmæum*, Dr., hitherto known in America as *Helix minutissima*, Lea. A full account of its history, with all published information relating to it, has been given by Mr. Bland and myself in Ann. of Lyc. Nat. His. of N. Y., X. 306. The jaw is low, wide, slightly arcuate, with blunt, squarely truncated ends; it is composed of sixteen separate pieces, each higher than wide, with slightly overlapping edges; these pieces do not run obliquely towards the middle of the jaw; there is, therefore, no appearance of an upper median triangular piece, as in *Orthalicus* and *Liguus*.

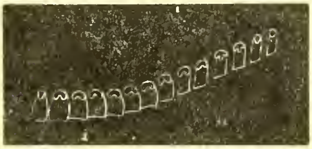
Fig. 288.



Jaw of *P. pygmæum* (Morse).

The lingual membrane is long and narrow. There are 54 rows of 13—1—13 teeth each. The centrals have a base of attachment much longer than wide, expanded below and squarely truncated, very much narrowed above, reflected. The reflection is very small, and has, according to Morse, one single cusp, but Schacko (Malak. Blätt., 1872, 178) describes the reflection in some European specimens as tricuspid. Laterals of same form as centrals, but with wider base of attachment in the first ones and biscuspid; outer laterals much narrower. There are no distinct marginals. All the teeth are decidedly separated.

Fig. 289.



Lingual dentition of *P. pygmæum* (Morse).

I have not examined the jaw or lingual membrane of this species, but am entirely dependent on Morse for the descriptions and figures of the American form given above. While treating of the identity of the American and European forms in the paper referred to above, we have pointed out the differences in the jaw and membrane of the two forms, which, however, do not appear to be of specific value.

Punctum pygmæum, Drap.

Shell umbilicated, subglobose, reddish horn-color, shining, marked with strong transverse striæ and microscopic revolving lines, both most prominent near the umbilicus; whorls 4, convex, gradually increasing, the last broadly umbilicated; aperture subcircular, oblique; peristome simple, acute, its columellar extremity subreflected. Greater diameter, 1½ mill; height, 1 mill.

Helix pygmæa, Drap., etc.

Helix minutissima, Lea, Trans. Am. Phil. Soc., IX. 17; Proc., II. 82 (1841); Obs., IV. 17 (1844); Troschel, Arch. f. Nat., 1843, II. 124. — Pfeiffer, Mon. Hel. Viv., I. 87. — W. G. Binney, Terr. Moll., IV. 100, Pl. LXXVII. Figs. 6, 7. — Morse, Am. Nat., I. 546, Fig. 45 (1867).

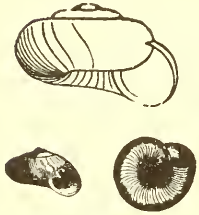
Helix minuscula, teste Binney, Terr. Moll., II. 221.

Punctum minutissimum, Morse, Journ. Portl. Soc., I. 27, Figs. 69, 70, Pl. VIII. Fig. 71 (1864). — W. G. Binney, L. & Fr.-W. Sh., I. 222 (1869).

Conulus minutissima, Tryon, Am. Journ. Conch., II. 257 (1866).

Hyalina minutissima, Gould and Binney, Inv. of Mass., (2), 403 (1870).

Fig. 290.



P. pygmæum.

Maine, Massachusetts, New York, Ohio, Bosque Co., Texas, in the Eastern Province; San Francisco, Lone Mountains, California, in Pacific Province. Probably will be found over all the continent. In Northern and Central Europe it has also an extensive range.

I repeat below the complete history of the species as given by Bland (Ann. Lyc. Nat. Hist. of N. Y., X. 306).

This species was described as *Helix minutissima* by Dr. Lea, in 1841. Its proper generic position was unknown, however, prior to 1864, when Professor Morse published figures of the jaw and lingual dentition (Journ. Portland Soc., I. p. 27, Fig. 70, Pl. VIII. Fig. 71).

He thus described the jaw: —

> The buccal plate is made up of sixteen long, slender, corneous laminæ, recurved at their cutting edges, these plates partially lapping over each other.

Morse remarked on the similarity between Lea's species and *H. pygmæa* Drap., of Europe, adding, "and it seems singular that it has never been referred to that species," but after examination of the jaw of the latter, as figured by Moquin-Tandon, Morse considered it generically distinct.

The following is Moquin-Tandon's description of the jaw of *H. pygmæa* (Moll. de France, II. p. 103, Pl. X. Fig. 2, 1855): —

> "*Mâchoire* large de 0.25^{mm}, peu arquée, mince, à peine cornée, transparente, assez facile à étudier à cause de la transparence des téguments; extrémités amincies; partie moyenne du bord libre un peu surbaissée; côtes verticales nombreuses, fines, serrées; crénelures très petites."

In W. G. Binney's Synopsis (Smith. Inst. Coll., p. 4, Dec., 1863), *Hyalina* (*Conulus*) *minutissima*, Lea, is enumerated, and Tryon (Amer. Journ. Conch., II. p. 257, 1866) placed the species in *Conulus*, while quoting the particulars given by Morse of the jaw.

In 1868, Lindström (Gotlands Nut. Moll., taf. III. Fig. 12) published figures, but without description, of the jaw of *H. pygmæa*. On comparison of this with Morse's figure of *minutissima*, the identity of the two species could scarcely be inferred.

In our Land and Fresh-water Shells (Part I. p. 221, 1869) we adopt *Punctum*, Morse, as the generic name of Lea's species, treating that genus as belonging to *Orthalicinæ*, by reason of the structure of the jaw.

W. G. Binney (Invert. Mass., 2d ed., p. 403, Fig. 665, 1870) has *Hyalina* *minutissima* as occurring in Massachusetts, adding in a note "the character of the jaw would place the species in the subfamily *Orthalicinæ,* as a distinct genus for which Morse's name *Punctum* might be retained, otherwise the species would be placed in *Hyalina.*"

Mr. J. Gwyn Jeffreys (Ann. &. Mag. Nat. Hist., Oct., 1872) refers to *Hyalina minutissima* as being identical with *Helix pygmæa*, Drap.

Dr. G. Schacko (Malak. Blätt., p. 178, 1872) has recently described both jaw and lingual teeth of *H. pygmæa*, showing that both have the same characters as ascribed by Morse to *Punctum minutissimum.*

The following is a translation of Schacko's description of the jaw of *H. pygmæa :* —

> The jaw consists of nineteen plates, which are grouped in the form of a horseshoe. They lie together like the tiles of a roof, and partially cover one another. The plates are connected by a fine transparent membrane. The middle plate, which is the largest, and perfectly straight at the top, lies entirely alone, so that a space is visible between it and the two next side-plates. These are smaller and of the same length, while the top is slightly curved. The plates have the same form as regards their length, but the curve increases towards the end plates. The third plate from the middle begins to cover the second, the fifth covers half of the fourth, and the succeeding plates always more, until the last covers two thirds of the preceding one.

The formula of the lingual membrane is given by Schacko as being 114 rows of 19—1—19; by Morse of Lea's species, 51 rows of 13—1—13.

The centrals of *H. pygmæa* are said by Schacko to be tricuspid; the two side cusps so small, and scarcely recognizable, that they entirely disappeared in one specimen ; the laterals bicuspid. He remarks that every tooth of the radula lies alone, so that even the cutting points do not cover or disturb the basal surfaces of the overlying rows.

Schacko refers to the near alliance, in form of jaw especially, of *H. pygmæa* with *H. minutissima* of the genus *Punctum* of Morse.

Looking at the descriptions and figures of the jaws of *pygmæa* and *minutissima*, we notice, with striking general similarity of characters, some differences ; on the other hand the lingual teeth of the two forms appear to be the same, and the shells without variation of specific value. The description of jaw and lingual dentition of the species is given above.

The facts regarding the distribution of *H. pygmæa*, which may be treated as one of the circumpolar species, favor the opinion, which we are disposed to adopt, that Lea's specific name must be placed in the synonymy of *Punctum pygmæum.*

Moquin-Tandon describes the genitalia of the European form to have neither dart nor multifid vesicles.

E. ELASMOGNATHA.

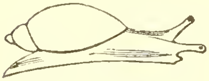
Jaw in a single piece, with an accessory, quadrate plate above. Marginal teeth quadrate.

SUCCINEA, Dr.

Animal heliciform, thick and blunt before, short and pointed behind; mantle central, simple, protected by a shell which does not conceal the whole retracted animal; respiratory and anal orifices on the right of the mantle edge, under the peristome; generative orifice behind the right eye-peduncle; no caudal mucus pore; locomotive disk (?).

Shell imperforate, thin, ovate or oblong; aperture large, obliquely oval; columella simple, acute; peristome simple, straight.

Fig. 291.



Animal of *S. rusticana.*

The genus is world-wide in its distribution.

The habits of the animal do not vary much from those of *Helix.* They are described in many works as being amphibious, which means that they possess the power of living in the water as well as upon the land. Such appears to have been the opinion of Lamarck. They are not, however, in any proper sense amphibious, as they live upon the land exclusively, and breathe air; and some of them occupy situations very distant from bodies of water. It is not difficult, however, to account for this general belief. Some of the species inhabit wet localities at the borders of swamps and ponds, and are even found attached to the leaves of plants growing out of the water. They resemble also, in external characters, certain species of *Limnæa,* which live in the water itself. The two have, therefore, been confounded in popular belief.

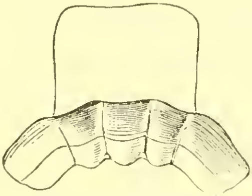
It is also stated very generally, that they cannot withdraw their bodies entirely into their shells. This is certainly an error as regards the American species, and probably as to all others. They all retire into their shells on the approach of winter, and during seasons of drought; every part of the body is then retracted within the plane of the aperture, and over it is extended a membranous epiphragm, like that of our *Helices.* They cannot, however, retract the body much beyond the plane of the mouth, and the foot is never wholly drawn into the aperture of the mantle and concealed by it, as in *Helix;* the posterior extremity of the locomotive disk being always visible, on a level with the mantle or collar.

The epiphragm sometimes possesses considerable thickness and consistence.

Jaw with an upper, quadrangular, accessory plate. The jaw is strongly arched, the ends acuminated in *S. avara* (Fig. 293), blunt in *obliqua, ovalis, Totteniana* (Fig. 292), *campestris, lineata,* and *effusa;* there is a median projection to the cutting margin, sometimes broken by the ends of ribs. These ribs are found in *S. Totteniana* (3) (see Fig. 292); *S. obliqua* (3 – 7); *ovalis* (over 7); I detected no ribs on that of *S. avara, lineata, campestris, Nuttalliana, Sillimani, Haydeni,* or *effusa.*

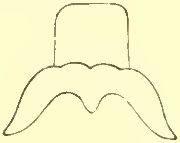
The general arrangement of the lingual membrane is as in *Patula*. The characters of the separate teeth are seen in Pl. X. Fig. K. The peculiar character of the dentition is the cutting away or thinning of the middle portion of the lower edge of the base of attachment in the central teeth, and the inner lower lateral angle of the base of attachment in the laterals and still more in the marginals. The marginal teeth are also often peculiar in the denticulation of their reflected cusps. They have usually two small outer side cusps, the inner the smaller, each bearing cutting points proportioned to their size. The reflection of the teeth is also small in proportion to the base of attachment. In other respects the dentition of the genus is very much like that of the *Heliceæ*.

Fig. 292.



Jaw of *S. Totteniana* (Morse).

Fig. 293.



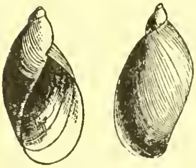
Jaw of *S. avara*.

The genital system in the species examined by me presents one peculiarity which may prove a generic character; the testicle is not separated into distinct fasciculi by the parenchyma of the liver, but forms a single mass. The prostate gland, also, is very much swollen, and extends only about the half of the length of the oviduct.

Succinea Haydeni, W. G. Binney.

Shell elongate-oval, thin, shining, amber-colored; spire short, acute; whorls 3, convex, the last marked with the wrinkles of growth, and irregular, heavy, spiral furrows; suture moderate; columella covered lightly with callus, and allowing all the interior whorls to be seen from below to the apex; aperture oblique, oval, five sevenths the length of the shell, the lower portion of its margin considerably expanded. Length, 21 mill.; diameter, 9 mill.

Fig. 294.



S. Haydeni.

Succinea Haydeni, W. G. Binney, Proc. Acad. Nat. Sci. Phila., X. 114 (May, 1858); Terr. Moll., IV. 40, Pl. LXXIX. Fig. 1. — Pfeiffer, Mal. Blätt., 1859, 52. — Bland, Ann. N. Y. Lyc., VIII. 168, Fig. 14 (1865). — Tryon, Am. Journ. Conch., II. 236 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 256 (1869).

A species of the Northern and Interior Regions. Nebraska, between the rivers Loup Fork and L'Eau qui Court.

Var. *minor*. Length, 15 mill. Found by Mr. Robert Kennicott near the Red River of the North, and at Fort Resolution, Great Slave Lake.

Animal of a uniform amber-color, judging from the specimens preserved in spirits in the collection of the Smithsonian Institute.

This is the largest known American *Succinea.*

Mr. Say describes *S. ovalis* as showing the interior apex from the base of the shell; in other respects his description does not apply to this shell. Its aperture is nearer that of *S. ovalis*, Gould not Say, but the peristome is much more flexuose, and the upper third of the shell becomes gradually attenuated, so as to give a sharp pointed appearance, though the spire itself is short. The revolving lines are sometimes continuous over the whole body-whorl, but generally interrupted, or confined to the interstices of the incremental striæ or wrinkles. It shares this peculiarity with *S. concordialis*, Gould, and *S. lineata.*

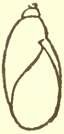
Named in honor of Dr. F. V. Hayden, the discoverer of the species.

Jaw without anterior ribs; lingual membrane as usual (Pl. XVI. Fig. R); teeth 35—1—35.

Succinea retusa, Lea.

Shell ovate-oblong, very thin, pellucid, yellowish; spire short; whorls 3; aperture below dilate and drawn back. Diameter .3, length .7 inch. Ohio, near Cincinnati.

Fig. 295.



S. retusa.

A single specimen only of this species has come into my possession. It differs so much from any of the described species in the dilatation and retraction of the inferior part of the aperture, that I have not hesitated to consider it new. (Lea.)

Succinea retusa, Lea, Trans. Am. Phil. Soc., V. 117, Pl. XIX. Fig. 86 (1837); Obs., I. 229. — DeKay, N. Y. Moll., 55 (1843). — Pfeiffer, Mon. Hel. Viv., II. 525. — Binney, Terr. Moll., III. 65, 66. — W. G. Binney, Terr. Moll., IV. 37, Pl. LXXIX. Fig. 7; L. & Fr.-W. Sh., I. 256 (1869). — Tryon, Am. Journ. Conch., II. 238 (1866).

Succinea campestris, Anthony, Ohio Cat., no descr., part (1843), No. 95.

Interior Region, near Cincinnati.

Mr. Lea's original description and figure are copied above.

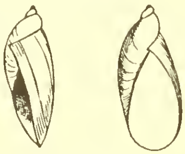
Jaw, lingual membrane, and genitalia not observed.

Succinea Sillimani, Bland.

Shell oblong-ovate, thin, coarsely striate, shining, whitish (?); spire short, acute; whorls 3, convex; suture impressed; aperture oblique, elongate-oval, angular above, effuse at the base; columella slightly arcuate, with a thread-like thickening above. Length 20, diameter 8½ mill.; aperture 13 mill. long, 6 broad in middle.

Succinea Sillimani, Bland, Ann. N. Y. Lyc., VIII. 167, Fig. 13 (1865). — Tryon, Am. Journ. Conch., II. 236 (1866).

Fig 296.



S. Sillimani.

Humboldt Lake, Nevada, in Central Province; in the Pacific Province at Stockton, Antioch, Mount Diablo, and in San Benito County, in California.

The original description and figure are given above.

Jaw as usual; no anterior ribs.

The lingual membrane (Pl. X. Fig. I) has 24—1—24 teeth, of the type usual to the genus.

Succinea ovalis, Gould, not Say.

Vol. III. Pl. LXVII. a, Fig. 3.

Shell ovate, somewhat conic, very thin, pellucid, watery horn-color, sometimes tinted roseate; periostraca shining, very minutely striate; whorls 3, the last compressed and elongate when viewed above; spire short but acute; suture impressed; aperture produced by a deep truncation of the shell, elongated, more than three fourths the length of the shell, patulous, expanding anteriorly, exhibiting the interior of the volutions; when viewed on the side of the aperture, the conical shape of the shell appears, the broadest part of the cone is below the centre of the aperture, and it tapers gradually to the apex. Extreme length 15 mill., of aperture 10 mill.

Succinea ovalis, Gould, Invertebrata, 194, Fig. 125 (1841), ed. 2, 445 (1870). — Adams, Shells of Vermont, 270. — Binney, Terr. Moll., II. 78, Pl. LXVII. a, Fig. 3. — W. G. Binney, Terr. Moll., IV. 37. — Pfeiffer, Mon. Hel. Viv., IV. 814. — Morse, Journ. Portl. Soc., I. 30, Fig. 77; Pl. IX. Fig. 78 (1864); Amer. Nat., I. 607, Fig. 48 (1868). — Tryon, Am. Journ. Conch., II. 237 (1866). — Not of Say.

Succinea Decampii, Tryon, Am. Journ. Conch., II. 237, Pl. II. Fig. 23 (1866).

Canada and the Northern and Middle States, thus belonging to both Northern and Interior Regions.

Animal a little longer than the shell, whitish or amber-colored, and translucent, with minute black dots, scattered and in clusters of dots upon the surface, most frequent upon the head and upper part of neck. Foot free from dots. A black line running from the ocular points of the eye-peduncles through their length, and along the sides of the neck to the shell, marking the sheath of the eye-peduncles, which are rather short, thick at base, attenuated towards the end, bulb distinct; tentacles short, small, and rather conical. Respiratory cleft near the peristome of the shell, about midway between its centre and its junction with the last whorl.

It appears to prefer the margins of water on wet and marshy ground, especially where there are fragments of wood saturated with water. We are not aware of its having been found in any other situation. It is also frequently taken on the leaves of flags (*Iris versicolor*), on the stems of *Pontederia* and other aquatic plants.

It deposits its eggs, to the number of about twenty, enveloped in a mass of thin transparent gelatine, at the foot of aquatic plants. These gelatinous masses are very numerous in the latitude of Boston, in the warm days of June. The eggs are oval and transparent.

This is not the *S. ovalis* of Say. That shell having been found identical with *S. obliqua*, Dr. Gould proposes retaining the name *ovalis* for this species.

Mr. Gwynn Jeffreys refers the species to *S. elegans*, Risso (Ann. and Mag. N. H., 1872, 246).

Jaw (according to Morse) arcuate, ends blunt; anterior surface with strong vertical furrows, which modify the concave margin.

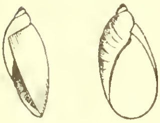
A specimen examined by me had a jaw with a smooth anterior surface and well-developed median projection.

Mr. Morse gives 80 rows of 40—1—40 teeth on the lingual membrane. A membrane examined by me (Pl. X. Fig. M) had over 60—1—60 teeth.

Succinea Higginsi, Bland.

Shell depressed-oval, thin, obliquely striated, pellucid, somewhat shining, pale horn-colored; spire short, obtuse; suture deep; whorls 3, convex, the last rather depressed; the columella scarcely arched, above conspicuously plicate; aperture angularly oval, frequently armed with a small, oblique, white tooth on the parietal wall; peristome simple, regularly arcuate. Length 15, diameter 7 mill.; aperture, 11 mill. long.

Fig. 297.



S. Higginsi.

Succinea Higginsi, Bland, Am. Journ. Conch., II. 373, Pl. XVII. Fig. 24 (1866). — Tryon, Am. Journ. Conch., II. 237 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 258 (1869).

Put-in-Bay Island, Lake Erie; a species of the Northern Region.

Animal not observed.

This species is allied to *S. Salleana*, Pfr., *S. Haydeni*, Binn., and especially to *S. ovalis*, Gould, not Say. Compared with the latter, the last whorl is less convex, the aperture is more angular above, the columella less arcuate, and more distinctly plicate.

The measurements given are of one of the largest specimens. This is the only North American species in which I have noticed the parietal tooth mentioned in the description. Three of my specimens have this tooth, — it is lamelliform, about 1 mill. in length at the base, the pointed apex having an elevation of about ½ mill. (Bland.)

Succinea Concordialis, Gould.

Vol. III. Pl. LXVII. a, Fig. 2.

Shell obliquely ovate, elongate, reflexed, apex acute, thin but firm, transparent, shining, feebly striated lengthwise and spirally, color pale honey-yellow, with the tip ruddy; whorls 3 and somewhat more, very oblique, the two uppermost very small, outer whorl somewhat compressed above the middle; suture well marked; aperture ample, not less than two thirds the length of the shell, well rounded at base; columella regularly arcuated, more so than the peristome, simple, but its upper portion is reflexed and raised so as to form a marginal wall to the aperture, as it enters the shell, and produces a slight fold where it disappears within the spire; a broad, thin callus covers the left margin, which is slightly detached anteriorly, so as to form the rudiment of an umbilicus. Length 14 mill., of aperture 9 mill

Succinea Concordialis, GOULD, Proc. Bost. Soc. Nat. Hist., III. 37 (June, 1848); in Terr. Moll., II. 82, Pl. LXVII. a, Fig. 2. — PFEIFFER, Mon. Hel. Viv., III. 16. — W. G. BINNEY, Terr. Moll., IV. 41; L. & Fr.-W. Sh., I. 260 (1869). — TRYON, Am. Journ. Conch., II. 239 (1866).

Succinea munita, BINNEY, Terr. Moll., I. in tables.

Lake Concordia, in Texas; a species of the Texan Subregion.

Jaw and lingual membrane as usual in the genus.

Succinea luteola, GOULD.

Vol. III. Pl. LXVII. c, Fig. 1.

Shell of a conical, turreted form, sometimes rather corpulent, and again quite slender, the last whorl being much less ventricose in proportion than the upper ones, rather thick in substance; color, when young, pale yellowish-green or drab, becoming bleached or gray with age, the interior, however, sometimes having the bright yellow of yolk of egg, and always more or less tinted thus when living, becoming at last dead white; surface irregularly and loosely wrinkled; whorls 4, forming a well-proportioned spire, the upper ones well rounded, and separated by a deep suture, the apex acute, colored yellow; last whorl conical at its upper third; aperture ovate, rather more than half the length of shell, the columellar extremity of the peristome somewhat incumbent; columella without a fold, rounded, its edge above being seen winding far within the spire. Length, 12½ mill.; breadth, 6 mill.

Succinea luteola, GOULD, Proc. Bost. Soc. Nat. Hist., June, 1848, III. 37; Terr. Moll., II. 75, Pl. LXVII. c, Fig. 1 (1851). — W. G. BINNEY, Terr. Moll., IV. 41; L. & Fr.-W. Sh., I. 261 (1869). — TRYON, Am. Journ. Conch., II. 239, Pl. II. Fig. 30 (1866). — PFEIFFER, Mon. Hel. Viv., III. 16.

Succinea Texasiana, PFEIFFER, olim, Mon. Hel. Viv., II. 526; in ROËMER'S Texas, 456 (1849); in CHEMNITZ, ed. 2, 42, Pl. IV. Figs. 21 - 23 (1854).

Succinea citrina, SHUTTLEWORTH, undescribed, teste PFR.

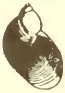
Florida and Texas; thus belonging to the Southern Region.

Animal not observed.

This species is very variable in its proportions, but is easily distinguished from our other species by its small aperture, elongated spire, and its color; its golden interior in fresh specimens, instead of the usual silvery lustre, being its principal characteristic. Its characters agree pretty well with a Mexican species described by Mr. Say under the name of *S. undulata;* and if any of our species were in view in that description, it must have been this one. In form it most resembles *S. avara*, but it differs in size and color. The shortest specimens resemble *S. campestris*, but there is no fold of the columella.

Succinea lineata, W. G. Binney.

Fig. 298.



S. lineata.

Shell oblong-ovate, with three very convex whorls; spire elevated, acute; surface marked with irregular wrinkles of growth, between which are coarse parallel revolving lines, somewhat removed from each other; aperture large, about as long as one half of the whole length of the shell, oval; columella folded; a deposition of callus on the parietal wall of the aperture. Greatest diameter, 6 mill.; altitude, 12 mill.

Succinea lineata, W. G. Binney, Proc. Acad. Nat. Sci. Phila., 1857, 19; Proc. Bost. Soc. Nat. Hist., VI. 155 (April, 1857); Terr. Moll., IV. 38, Pl. LXXX. Fig. 5; L. & Fr.-W. Sh., I. 262 (1869). — Tryon, Am. Journ. Conch., II. 235 (1866).

Fort Union, Nebraska Territory; also in New Mexico, Arizona, and Sonora, Mexico; thus it belongs to both the Interior Region of the Eastern Province and to the Central Province.

The specimens collected being dead and eroded, it is impossible to say what is the color of the shell when fresh. It is probably ashy-white, resembling the true *S. campestris* of the Southern States. The revolving lines which distinguish it are most apparent on the middle of the body-whorl. These are quite coarse, and placed at irregular intervals, — on some specimens scarcely discernible. The aperture is unlike that of any other of our species; being correctly egg-shaped, it is nearest in form to that of *S. campestris*, but is less expanded. The parietal wall of the aperture is unusually horizontal.

In general aspect it resembles somewhat *S. vermeta*, but is distinguished from that shell by its more oval shape and the greater convexity of the whorls. It is the heaviest American species.

This species must not be confounded with *S. lineata*, DeKay.

Jaw as usual; no anterior ribs.

The lingual membrane (Pl. X. Fig. L) has 26—1—26 teeth, with 4 perfect laterals, but the transition to marginals is very gradual. The teeth have a very broad base of attachment, and very slender, sharp cutting points.

Succinea avara, Say.

Vol. III. Pl. LXVII. c, Fig. 4.

Shell rather small, very thin and fragile, straw-colored, rosy, amber-colored or greenish; periostraca shining, or presenting minute hairy processes in the young; whorls 3, very convex, separated by a deep suture; last whorl rather large, not much expanded; spire very prominent, acute; aperture ovate, rounded at both extremities, about half as long as the shell. Extreme length, about 6 mill.

Succinea avara, Say, Long's Exped., II. 260, Pl. XV. Fig. 6 (1822); Binney's ed. 32, Pl. LXXIV. Fig. 6. — Gould, Invertebrata, 196, Fig. 127 (1841). — Adams, Shells of Vermont, 156 (1842). — DeKay, N. Y. Moll., 54, Pl. IV. Fig. 55 (1843). — Pfeiffer, Symbolæ, II. 56; Mon. Hel. Viv., II. 525; in Chemnitz, ed. 2, 51, Pl. V. Figs. 18 - 20 (1854). — Binney, Terr. Moll., II. 74, Pl. LXVII. c, Fig. 4. — W. G. Binney, Terr. Moll., IV. 35; L. & Fr.-W. Sh., I. 262 (1869). — Morse, Journ. Portl. Soc., I. 29, Fig. 75; Pl. IX. Fig. 76 (1864); Amer. Nat., I. 607, Fig. 47 (1868). — Tryon, Am. Journ. Conch., II. 233 (1866).

Succinea Wardiana, Lea, Proc. Am. Philos. Soc., 1841, II. 31; Trans., IX. 3; Obs., IV. 3 (1844). — Pfeiffer, Mon. Hel. Viv., II. 525.

Succinea vermeta, Say, teste Gould (see doubtful species, p. 430). — Tryon, Am. Journ. Conch., II. 233, Pl. II. Fig. 10 (1866).

From Fort Simpson, on Mackenzie River, to the Gulf of Mexico; over all the Eastern Province; also in Colorado and New Mexico, of the Central Province.

Head dark; foot flesh-colored, narrow.

A larger form is also found.

This shell at first sight appears to be the young of some of the larger species, but it has as many whorls as any of them, though not attaining more than one fourth part their size. It differs from all others in having a long and pointed spire, and in its shorter aperture, which is only half as long as the shell. The whorls do not expand so fast from the apex towards the aperture, and the last whorl consequently forms a much smaller part of the whole volume of the shell. One of its characters, but not entirely peculiar to it, is the loose manner in which the whorls are united, the suture being in some instances so deep as nearly to separate them. This variety was considered by Mr. Say to be a distinct species, and described by him under the name of *Succinea vermeta*. We have carefully compared *Succinea Wardiana*, Lea, with the present species, but cannot detect any difference.

In the young shells the spire is not so prominent, and the periostraca is covered with numerous fine, hairy processes, as in some *Helices*, which accumulate particles of dirt, which in this way sometimes coat over its entire surface. The apex of the spire is often rosy.

Found under stones and fragments of wood in moist places, and often on hillsides and other positions far removed from water.

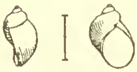
Allied to *S. putris*, var. *ochracea*, according to Mr. Gwynn Jeffreys (Ann. Mag. Nat. Hist., 1872, 246).

Jaw strongly arcuate, ends curved and pointed; anterior surface smooth; concave margin simple, with a well-developed, acute median projection; convex margin waving.

Lingual membrane (Pl. X. Fig. K) with 21—1—21 teeth, with about 8 perfect laterals. Morse counted 19—1—19 teeth.

Succinea Stretchiana, Bland.

Fig. 299.



S. Stretchiana.

Shell globose-conic, thin, pellucid, shining, striatulate, greenish horn-colored; spire short, rather obtuse; suture deep; whorls 3, convex, the last roundly inflated; columella arcuate, slightly thickened, receding; aperture oblique, roundly oval; peristome simple, with the margins joined by a thin callus. Length, 6¼ mill. diameter, 5 mill.; aperture, 5 mill. long.

Succinea Stretchiana, Bland, Ann. N. Y. Lyc., VIII. 168, Fig. 16 (1865). — Tryon, Amer. Journ. Conch., II. 231, Pl. II. Fig. 5 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 264 (1869).

In both Central Province and Californian Region; Little Valley, Washoe County, Nevada, on the eastern slope of the Sierra Nevada, 6,500 feet above the sea; Mariposa County, California.

The original description and figure are given above.

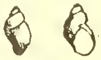
Jaw as usual; no anterior ribs.

The lingual membrane (Pl. X. Fig. J) has 16—1—16 teeth and 8 laterals.

Succinea Verrilli, Bland.

Shell ovate-conic, thin, striate, subpellucid, orange-yellow colored; spire elevated, obtuse, with globose apex, of a reddish tinge; whorls 3, very convex; suture deep; aperture oblique, roundly oval; columella arcuate, with a slight callus; peristome simple, the margins joined with a very thin callus. Length, 7 mill.; diameter, 3½ mill.; aperture, 4 mill. long, 3 wide.

Fig. 300.



S. Verrilli.

Succinea Verrilli, Bland, Ann. N. Y. Lyc., VIII. 169, Fig. 17 (1865). — Tryon, Am. Journ. Conch., II. 234 (1866). — W. G. Binney, L. & Fr.-W. Sh., I. 254 (1869).

Salt Lake, Anticosti Island, Gulf of St. Lawrence, is the only locality thus far known; it must thus be counted among the species of the Northern Region.

Animal (in alcohol) black.

The original description and figure are given above.

Jaw abruptly arched, with one prominent central projection.

Lingual membrane with about 80 rows (31—1—31); base of attachment notched at its outer posterior edge, longer than wide; central tooth with three minute denticles, the middle one being largest; lateral teeth bidentate, the outer denticle minute; marginal teeth irregularly dentate or notched. (Morse.)

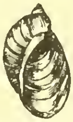
Succinea aurea, Lea.

Vol. III. Pl. LXVII. c, Fig. 2.

Shell very symmetrical in form, elongated-oval, the texture very thin and lucid, and of a clear amber-color; whorls 3, the suture deeply impressed, and the whorls a little tabulated posteriorly; aperture narrow-ovate, acute posteriorly; the columella has an indistinct fold. Length, 7½ mill.; breadth, 3 mill.

Succinea aurea, LEA, Trans. Am. Phil. Soc., IX. 4; Obs., IV. 4 (1844); Proc., 1841, II. 32. — PFEIFFER, Mon. Hel. Viv., II. 325. — BINNEY, Terr. Moll., II. 76, Pl. LXVII. c, Fig. 2. — W. G. BINNEY, Terr. Moll., IV. 37. — L. & Fr.-W. Sh., I. 264 (1869). — TRYON, Am. Journ. Conch., II. 241 (1866).
Succinea ovalis, var., ANTHONY, Shells of Ohio (1843), No. 45, no descr.

Fig. 301.



S. aurea, enlarged.

A species of the Interior Region, but restricted as far as yet known to Ohio.

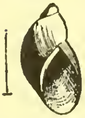
Animal not observed.

This small species is about the size of *S. avara*, but it is less ventricose in form, and of a more vitreous structure, and more yellow cast of color. The aperture, especially, is far less rounded; indeed, it is more narrow than in any other American species.

Succinea Grœnlandica, BECK.

Shell elongated, rather heavy, lightly wrinkled, of a light horn-color mixed with white; spire scalariform, bulbous; whorls 4, the penultimate quite convex, the last equalling two thirds the length of the shell; columella receding and narrowed, covered with a white callus; aperture oval; peristome simple, the right margin covered. Greatest length, 8 mill.; breadth, 5½ mill.; length of aperture, 5½, breadth, 3½ mill.

Fig. 302.



S. Grœnlandica.

Succinea Grœnlandica, BECK, Ind. — PFEIFFER, Mon. Hel. Viv., II. 529. — MÖLLER, Ind. Moll. Gr., 4 (1842). — W. G. BINNEY, Terr. Moll., IV. 38, Pl. LXXX. Fig. 4; L. & Fr.-W. Sh., I. 265 (1869). — TRYON, Am. Journ. Conch., II. 234, Pl. II. Fig. 13 (1866). — MÖRCH, Am. Journ. of Conch., IV. 31, Pl. III. Fig. 10 (1868).

Greenland and Iceland, and perhaps Denmark (Mörch., l. c.). I must treat it as one of the circumpolar species of the Northern Region.

Animal not observed.

This species is easily distinguished by its bulbous, turreted spire, and by its light horn-color, broken by longitudinal white vittæ. When the epidermis is removed, the shell is of a dead white. The specimen figured is in Mr. Bland's collection.

The jaw is said by Mörch to have lateral denticles as in *S. amphibia.*

Succinea obliqua, SAY.

Vol. III. Pl. LXVII. b Fig. 3.

Shell ovate, pale green, yellowish-green, amber-colored, or cinereous, very thin and fragile, pellucid, sometimes roseate at apex; periostraca shining, minutely wrinkled or striated; whorls rather more than three, the last very large, and much expanded, and more or less oblique; spire very small, not prominent nor pointed; suture distinct, impressed; aperture oval, large, and expanded, more or less oblique; columellar margin with a slight testaceous glazing; columella thin, sharp, narrowed; peristome thin, its edge blunted by the reflection of the periostraca. Greatest length, 25 mill.; ordinary length, 18 mill.

Succinea obliqua, SAY, Long's Exped., II. 260, Pl. XV. Fig. 7 (1824); BINNEY'S ed. 32, Pl. LXXIV. Fig. 7. — ADAMS, Shells of Vermont, 156, with fig. (1842). — DEKAY, N. Y. Moll., 53, Pl. IV. Fig. 53 (1843). — PFEIFFER, Mon. Hel. Viv., III. 15; in CHEMNITZ, ed. 2, 47, Pl. V. Figs. 1, 2 (1854). — BINNEY, Terr. Moll., II. 69, Pl. LXVII. b, Fig. 3, excl. syn., *Totteniana.* — W. G. BINNEY, Terr. Moll., IV. 35; L. & Fr.-W. Sh., I. 265 (1869). — LEIDY, T. M. U. S., I. 258, Pl. XIII. Figs. 1-3 (1851), anat. — TRYON, Am. Journ. Conch., II. 232 (1866). — GOULD and BINNEY, Inv. of Mass., ed. 2, 447 (1870).

Succinea ovalis, SAY, Journ. Acad., Nat. Sci. Phila., I. 15 (1817); Nich. Encycl., 3d ed. (1819); BINNEY'S ed. 8. — ADAMS, Shells of Vermont, 156 (1842). — DESHAYES, in Encycl. Méth., II. 20 (1830); FÉR., Hist., l. c., II. 139 (excl. syn., GOULD); in LAM., ed. 2, VIII. 319. — PFEIFFER, Mon. Hel. Viv., II. 524; III. 15 (excl. syn. GOULD); in CHEMNITZ, ed. 2, 48, Pl. V. Figs. 3, 4.

Succinea lineata, DEKAY, N. Y. Moll., 53, Pl. IV. Fig. 51 (olim), 1843.

Succinea campestris of all American authors except SAY. — GOULD, Invert., 195, Fig. 126 (1841). — DEKAY, N. Y. Moll., 54, Pl. IV. Fig. 54 (1843).

Succinea Greerii, TRYON, Am. Journ. Conch., II. 232, Pl. II. Fig. 8 (1866).

A Post-pleiocene species, now found in the Northern and Interior Regions from Gaspé to Georgia, and from the Red River of the North to Arkansas.

Animal with eye-peduncles blackish, their base large and conical; tentacles under the last, white, very small. Head and neck finely mottled with black, mantle grayish, foot light saffron-color, a saffron border around the respiratory foramen. A deep furrow running from under the anterior part of the mantle, on each side, downward and forward, terminating behind the tentacle. Length of the animal somewhat more than that of the shell.

Like the other species, it prefers moist situations, but it is also spread abroad upon the hillsides, as in Vermont, at considerable distances from water.

When the shell is oval, the last whorl very ample and expanded, forming nine tenths of the whole volume, and but little oblique, the spire being at the same time very small and not prominent, and the aperture oval and well rounded at both extremities, it is the form described as *Succinea ovalis* by Mr. Say. The variation to which it is most subject is a lengthening and narrowing of all its parts. The spire becomes more produced, and its convolutions less close; the last whorl is compressed at the sides, and more oblique. The aperture by this process becomes elongated and narrow, and its posterior margin more angulated. In this condition it is *Succinea obliqua*, Say. The extremes of the two varieties differ much from each other, yet they are blended together by almost inappreciable degrees of variation, and we have never met with specimens in the Northern States which could not be referred to one or the other of these varieties.

Jaw of shape usual in the genus, with the quadrate accessory plate. Cutting edge with a prominent median projection. Anterior surface with decided stout ribs denticulating the cutting edge; one specimen had three broad and two intervening narrow ribs; another specimen has seven ribs.

Lingual membrane (Pl. X. Fig. P) long and narrow. Teeth about 43—1—43. Centrals subquadrate, tricuspid, the middle cusp long and stout. Laterals about 10, longer than wide, bicuspid, the third inner cusp being only rudimentary. Marginals a modification of the laterals, with one long, slender inner cusp, and two short, slender outer cusps. The cusps of all the teeth bear sharp cutting points.

In Vol. I. Pl. XIII. Fig. 3, a jaw is figured as that of *Succinea ovalis.* It no doubt represents rather that of the true *obliqua*, Say, than that of *Succ. ovalis*, Gld. not Say. The jaw of the latter is figured in L. & Fr.-W. Shells of N. A., I. p. 258. The figure of genitalia given by Dr. Leidy on the plate referred to correctly represents that of *S. obliqua.*

The genital system is figured (under the name of *S. ovalis*) by Leidy, l. c. The testicle is not separated into distinct fasciculi by the parenchyma of the liver as in *Helix*, but forms a single mass; the epididymis is very much convoluted, and appears always to be distended with spermatic matter; the prostate gland is usually short, occupying the upper half only of the length of the oviduct, and is thick, clavate, and more or less colored by pigmentum nigrum cells upon the surface; the penis sac is long, cylindroid, curved downward at its upper part, and is joined at its summit by the vas deferens; the retractor muscle is inserted into the penis sac a short distance below its summit; the genital bladder is large and globular, its duct is nearly as long as the oviduct, and is narrow; the vagina is moderately long and muscular; the cloaca is short.

It will be interesting to study the genitalia of other species of the genus in order to ascertain whether the peculiarities of the testicle being free and the prostate gland short are generic characters. In *S. campestris* the same arrangement is found.

Succinea Totteniana, Lea.

Vol. III. Pl. LXVII. b, Fig. 2.

Shell obliquely ovate, of a greenish color, thin, shining, somewhat diaphanous, obsoletely striated; whorls 3, convex, the last very large and globose; spire very short; suture impressed; aperture large, oval, oblique; peristome thin, acute. Greatest length, 16 mill.

Succinea Totteniana, Lea, Proc. Phil. Soc., II. 32 (1841); Trans. Amer. Phil. Soc., IX. 4 (1844); Obs., IV. 4. — Pfeiffer, Mon. Hel. Viv., II. 526; III.

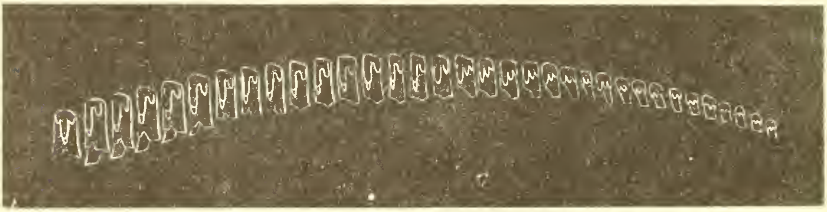
15. — Gould, in Terr. Moll., II. 65, 72, Pl. LXVII. b, Fig. 2. — W. G. Binney, Terr. Moll., IV. 35; L. & Fr.-W. Sh., I. 266 (1869). — Morse, Journ. Portl. Soc., I. 29, Fig. 73; Pl. IX. Fig. 74 (1864); Amer. Nat., I. 606, Fig. 46 (1868). — Tryon, Amer. Journ. Conch., II. 230 (1866). — Gould and Binney, Inv. of Mass. (2), 448 (1870).

Succinea obliqua, teste Binney, l. c.

New England and New York; in Interior and Northern Regions.

Generally considered a variety of *S. obliqua.* It is a thinner and more fragile shell, proportionally more ventricose in form, with a shorter spire and larger aperture; it has a decided green color, almost unshaded with yellow, while in *S. obliqua* the amber yellow predominates.

Fig. 303.



Lingual membrane of *S. Totteniana* (Morse).

By Gwynn Jeffreys referred to *S. putris* var. (Ann. Mag. Nat. Hist., 1872).

Jaw arcuate, ends blunt; anterior surface with three heavy ribs, modifying the concave and convex margins. (See p. 415.)

The lingual membrane is said by Morse, whose figure is given above, to have 100 rows of 33—1—33 teeth. The bases of attachment are very narrow, and have a peculiar expansion at their lower inner angles.

Succinea campestris, Say.

Vol. III. Pl. LXVII. b, Fig. 1.

Shell yellowish-white, or yellowish horn-color, rounded-ovate; periostraca shining, wrinkled; whorls 3, not oblique, the last whorl large and ventricose, the other two constituting the spire; spire short, with acute apex; aperture ample, not much elongated, rounded anteriorly; peristome thin and sharp. Length 15, of aperture 10 mill.

Succinea campestris, Say, Journ. Acad. Nat. Sci. Phila., I. 281 (1817); Nich. Encycl., 3d ed. (1819); Binney's ed., 12. — Férussac, Tabl. Syst., 31, Pl. XI. Fig. 12. — Pfeiffer, Symbolæ, II. 56 (excl. syn. Gould); Mon. Hel. Viv., II. 524 (excl. do.); III. 15 (excl. syn. DeKay); in Chemnitz, ed. 2, 48, Pl. V. Figs. 5, 6 (1854). — Deshayes, in Fér., II. 139. — Binney, Terr. Moll., II. 67, Pl. LXVII. b, Fig. 1. — W. G. Binney, Terr. Moll., IV. 32; L. & Fr.-W. Sh., I. 266 (1869). — Tryon, Am. Journ. Conch., II. 231 (1866), not of DeKay, Adams, Linsley, Anthony, Prescott (no desc.).

Succinea inflata, LEA, Trans. Am. Phil. Soc., IX. 5; Obs., IV. 5 (1844); Proc., II. 31 (1841). — PFEIFFER, Mon. Hel. Viv., II. 526; in CHEMNITZ, ed. 2, 49, Pl. V. Figs. 9–11 (1854). — W. G. BINNEY, Terr. Moll., IV. 34, Pl. LXXX. Fig. 11. — TRYON, Am. Journ. Conch., II. 230 (1866).

Succinea unicolor, TRYON, Am. Journ. Conch., II. 230, Pl. II. Fig. 3 (1866).

It is a strictly Southern Region species, observed as yet only in Florida and Georgia.

Whitish; eyes, tentacula, and a line passing from the eyes disappearing under the shell, black; a gamboge-colored vitta is visible through that part of the shell which is opposed to the mouth. At St. Augustine I found specimens copulating in December.

Jaw as usual; no anterior ribs.

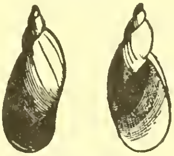
The lingual membrane (Pl. X. Fig. O) has 18—1—18 teeth, with about 10 perfect laterals. Morse gives 50 rows of 30—1—30 teeth. The central tooth has a peculiarly narrow base of attachment, and a very greatly developed median cusp, the side cusps being subobsolete.

Genitalia as in *S. obliqua* (q. v.).

Succinea Hawkinsi, BAIRD.

Shell elongate-obovate, thin, pellucid, shining, undulately striated, pinkish, within pearly; spire acute; whorls 4, convex, the last equalling two thirds the shell's length; suture impressed; aperture oval, effuse below. Length $\frac{3}{4}$, lat. $\frac{1}{3}$ inch.

Fig. 304.



S. Hawkinsi.

Hab. Lake Osoyoos, British Columbia. (Brit. Mus.)

This shell is of an elegant form, and of a pinkish color, with the interior of a pearly lustre. It is smooth and shining, but marked with waved striæ of lines of growth. It resembles very much in figure the *Succinea Pfeifferi* of Europe, but is of a still more elegant shape and of a brighter hue.

I have named it after Lieutenant-Colonel Hawkins, R. E., Commissioner of the British North American Boundary Commission. (Baird.)

Succinea Hawkinsii, BAIRD, Proc. Zoöl. Soc., 1863, 68, in LORD'S Nat. in Vancouver's Island, II. 362 (1866). — BLAND, Ann. N. Y. Lyc., VIII. 168, Fig. 16 (1865). — TRYON, Amer. Journ. Conch., II. 240 (1866). — W. G. BINNEY, L. & Fr.-W. Sh., I. 268 (1869).

A species of the Northern Region, confined to British Columbia, as far as now known.

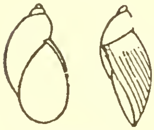
Animal unknown.

Fig. 304 is copied from the original figure.

Succinea rusticana, GOULD.

Shell elongate, ovate-conical, rather large, thin, and fragile, pale greenish horn-color, surface rude and without lustre, coarsely and irregularly marked by the lines of growth; spire acute, of 3 or more moderately convex whorls, separated by a well-impressed suture, the last whorl large and long, narrowing towards the base; body portion of the face of the shell moderately large; aperture ovate, three fourths the length of the shell; fold of the columella distinct. Length of axis 12½, breadth 6¼ mill.

Fig. 305.



S. rusticana.

Succinea rusticana, Gould, Proc. Bost. Soc. Nat. Hist., II. 187 (Dec. 1846); Mollusca of Expl. Exped., 28, Fig. 29 (1852). — Pfeiffer, Mon. Hel. Viv., II. 523. — W. G. Binney, Terr. Moll., IV. 6, Pl. LXXIX. Fig. 14; L. & Fr.-W. Sh., I. 269 (1869). — Tryon, Am. Journ. Conch., II. 263 (1866).

Oregon to Tulare Valley, California; White Pine, Nevada, thus belonging to both Central and Pacific Provinces.

For a figure of the animal, see p. 414

Jaw, lingual dentition, and genitalia unknown.

Succinea Nuttalliana, Lea.

Vol. III. Pl. LXVII. a, Fig. 4.

Shell lanceolate-ovate, thin, and fragile, of a dull horn-color, somewhat rudely undulated by the lines of growth; composed of about 3 tumid whorls, forming a conical spire, the last whorl constituting nearly the whole shell; suture well-marked; aperture nearly two thirds the length of the shell; ovate, broadly rounded in front, the posterior angle being also somewhat rounded by the abrupt curvature of the peristome; columella very gently curved, the region being somewhat gibbous; no fold on the columella, but in the region of the spire it is slightly sinuous. Length 13, of aperture 10 mill.

Succinea Nuttalliana, Lea, Proc. Am. Phil. Soc., II. 32 (1841); Trans., IX. 4 Obs., IV. 4 (1844). — Pfeiffer, Mon. Hel. Viv., II. 523. — Binney, Terr. Moll., II. 81, Pl. LXVII. a, Fig. 4. — W. G. Binney, Terr. Moll., IV. 6; L. & Fr.-W. Sh., I. 269 (1869). — Tryon, Am. Journ. Conch., II. 236 (1866).

Oregon and California, in the Pacific Province.

Jaw as usual; no anterior ribs.

The lingual membrane has 19—1—19 teeth (Pl. XVI. Fig. R). Another lingual membrane had 50 rows of 30—1—30 teeth; centrals obtusely tricuspid; laterals bicuspid; marginals tridentate, the inner tooth much the largest.

Succinea Oregonensis, Lea.

Vol. III. Pl. LXVII. c, Fig. 3.

Shell elongated-ovate, thin, of a somewhat saffron-yellow color, rather coarsely, though obtusely and distantly striated transversely; spire with 2½ or 3 well-rounded whorls, separated by a distinct suture, the last whorl seven eighths the length of the shell; aperture two thirds the length of the shell, strictly ovate, one third longer than broad; columella arcuate, but not folded, a thin white callus of considerable extent covering it. Length, 6¼ mill.; greatest lateral diameter 3⅛, least 2½ mill.

Succinea Oregonensis, LEA, Proc. Am. Phil. Soc., II. 32 (1841); Trans., IX. 5; Obs., IV. 5 (1844). — PFEIFFER, Mon. Hel. Viv., II. 523. — BINNEY, Terr. Moll., II. 77, Pl. LXVII. Fig. 2. — W. G. BINNEY, Terr. Moll., IV. 6; L. & Fr.-W. Sh., I. 270 (1869). — TRYON, Am. Journ. Conch., II. 235 (1866).

Succinea Gabbii, TRYON, Am. Journ. Conch., II. 234, Pl. II. Fig. 14 (1866).

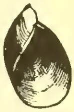
Oregon and California, in the Pacific Province.

Animal unknown.

Compared with *S. aurea*, it is much smaller, and combines red in its coloration; the aperture is more rounded at base, so as to be more broadly ovate; the whorls are also more rounded. Grains of sand adhere to its surface, much as in the young of *S. avara*, but no epidermal hairs have been noticed.

Succinea effusa, SHUTTLEWORTH.

Fig. 306.



S. effusa.

Shell depressed-oval, very thin, transparent, and shining, lightly striated, grayish horn-colored; spire remarkably short, acute; whorls 2½, the last one very much the largest, depressed, equalling five sixths the length of the shell; columella scarcely rounded and hardly receding; aperture very large, oblique, and oval; peristome simple, regularly rounding. Length 12, diameter 7 mill.; length of the aperture 10, breadth 6 mill.

Succinea effusa, SHUTTLEWORTH, MSS. — PFEIFFER, Mon. Hel. Viv., III. 17; in CHEMNITZ, ed. 2, 42, Pl. IV. Figs. 18–20 (1854). — W. G. BINNEY, Terr. Moll., IV. 41, Pl. LXXX. Fig. 12; L. & Fr.-W. Sh., I. 270 (1869). — TRYON, Am. Journ. Conch., II. 231 (1866).

East Florida; Spring Garden, Lake Florida: in the Florida Subregion.

It is readily distinguished from the other American species by the proportionally short spire, the very large body-whorl, and expanded aperture.

Jaw strongly arched; ends blunt, attenuated; cutting edge deeply concave and furnished with a prominent pointed beak; anterior surface with vertical and horizontal striæ, but no grooves or rib-like processes; accessory plate large, subquadrate.

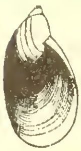
Lingual membrane (Pl. X. Fig. N) has 15—1—15 teeth, with 10 perfect laterals

Succinea Salleana, PFEIFFER.

Shell depressed-ovate, very thin, delicately striated, irregularly marked with impressed spiral lines, pellucid, shining, whitish horn-colored; spire very short, subtuberculous; whorls 2½, the penultimate convex, the last exceeding three fourths the length of the shell; columella with a slight callus, strictly receding;

aperture subparallel to the axis, angularly oval; peristome subthickened, its right end scarcely arched. Length, 19 mill.; diameter, 10 mill.; height, 17 mill.; length of aperture, 16 mill.; breadth below middle, 9 mill.

Fig. 307.



S. Salleana.

Succinea Salleana, PFEIFFER, Proc. Zoöl. Soc., Nov., 1849, 133; Mon. Hel. Viv., III. 16; in CHEMNITZ, ed. 2, 49, Pl. V. Figs. 7, 8. — W. G. BINNEY, Terr. Moll., IV. 42, Pl. LXXIX. Fig. 18; L. & Fr.-W. Sh., I. 270 (1869). — TRYON, Am. Journ. Conch., II. 240 (1866).

Near New Orleans; belonging, perhaps, to the Texas Subregion.
Animal not observed.

DOUBTFUL AND SPURIOUS SPECIES OF SUCCINEA.

Succinea putris, LIN. (DESHAYES, Encycl. Méth., 21; DEKAY, 1839, 31; FÉRUSSAC, Tabl. Syst., 9), and

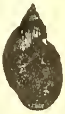
Succinea amphibia, DRAP. (FORBES, Brit. Ass., 1837, 144; FÉRUSSAC, Tabl. Syst.; BINNEY, Terr. Moll., II. 159; MRS. SHEPPARD, Tr. Lit. Hist. Soc. Quebec, 1829, I. 194), have been quoted from America. Having never seen a well-authenticated specimen of either, I omit them.

Succinea vermeta, SAY, New Harm., Diss., II. 230 (1829); Desc. 23 (1840); ed. BINNEY, 38 (*S. venusta*, W. G. B., err. typ.). Gould quotes this in the synonymy of *S. avara*. See Terr. Moll., II. 64, 73, and above, p. 421.

Succinea aperta, LEA, Trans. Amer. Philo. Soc., VI. 101, Pl. XXIII. Fig. 101; Obs., II. 107 (1839), is said by GOULD (Terr. Moll., II. 67) to be identical with *S. rotundata*, of Sandwich Islands.

Succinea pellucida, LEA (Proc. Acad. Nat. Sci. Phila., 1864, 109; Journ. of same; Obs., XI. 134, Pl. XXIV. Fig. 106), appears to me to be *Limnæa columella*. A figure of an authentic specimen, received from Mr. Lea, is here given.

Fig. 308.

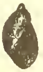


S. pellucida.

Succinea oblonga and *putris*, credited to North America by PRESTWICH, Quart. Journ. Geol. Soc., XXVII. 493.

Succinea Haleana, LEA. — Shell obliquely ovate, shining, somewhat transparent, thin, golden color; spire short; sutures impressed; whorls 3, convex; aperture large, broadly oval; outer lip regularly expanded; columella incurved. Diameter, .17 mill.; length, .23 inch. Alexandria, Louisiana. (Lea.)

Fig. 309.



S. Haleana.

Succinea Haleana, LEA, Proc. Acad. Nat. Sci. Philad., 1864, 109. — TRYON, Am. Journ. Conch., II. 241 (1866).

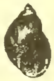
Succinea Halei, LEA, Journ. Acad. Nat. Sci. Philad.; Obs., XI. 136, Pl. XXIV. Fig. 110.

Mr. Lea's original description is here given. Fig. 309 is drawn from a specimen received from him. See, also, L. &. Fr.-W. Sh., I. 259, 1869.

Succinea Mooresiana, LEA. Shell obliquely oval, minutely striate, opaque, whitish, somewhat thin; spire exserted; sutures impressed; whorls 3, a little convex; aperture nearly round; outer lip expanded; columella incurved and twisted. Diameter .24, length .39 inch. Court House Rock on Platte River. (Lea.)

Succinea Mooresiana, Lea, Proc. Acad. Nat. Sci. Philad., 1864, 109; Journ. of the same, Pl. XXIV. Fig. 109; Obs., XI. 136, Pl. XXIV. Fig. 109. — Tryon, Am. Journ. Conch., II. 235 (1866).

Fig. 310.

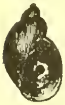


S. Mooresiana.

The above is Mr. Lea's original description. Fig. 310 is drawn from a specimen furnished by him. See also L. & Fr.-W. Sh., I. 259 (1869).

Succinea Grosvenorii, Lea. Shell obliquely ovate, striate, somewhat transparent, straw-yellow, and thin; spire exserted; sutures very much impressed; whorls 4, convex; aperture nearly round, and rather large; outer lip expanded; columella bent in and twisted. Diameter .32, length, .51 inch. Santa Rita Valley, Kansas? and Alexandria, Louisiana.

Fig. 311.



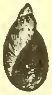
S. Grosvenorii.

Succinea Grosvenorii, Lea, Proc. Acad. Nat. Sci. Philad., 1864, 109; Journ. Acad. Nat. Sci. Philad., Pl. XXIV. Fig. 108; Obs. XI. 135, Pl. XXIV. Fig. 108. — Tryon, Am. Journ. Conch., II. 232 (1866).

Succinea Forsheyi, Lea, Proc. Acad. Nat. Sci. Philad., 1864, 109; Journ. of same; Obs., XI. 134, Pl. XXIV. Fig. 107. — Tryon, Am. Journ. Conch., II. 239, Pl. II. Fig. 28 (1866).

The original description of this species is given above, and a figure of an authentic specimen. The same is given below of *S. Forsheyi*, which appears to me identical.

Fig. 312.

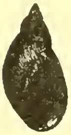


S. Forsheyi.

Succinea Forsheyi. Shell obliquely elongate, smooth, polished, semi-transparent, pale golden color, very thin; spire exserted, pointed; sutures impressed; whorls 3, a little convex; aperture large, wide, ovate; outer lip somewhat expanded; columella thin, incurved and twisted. Diameter, .23, length, .46 inch. Rutersville, Texas. (Lea.) See also L. & Fr.-W. Sh., I. 259 (1869).

Succinea Wilsoni, Lea. Shell obliquely elongate, very much striate, transparent, deep golden color, and somewhat large, ovate; outer lip somewhat expanded; columella thin, incurved and twisted. Diameter .30, length .66 inch. Darien, Georgia. (Lea.)

Fig. 313.



S. Wilsoni.

Succinea Wilsoni, Lea, Proc. Acad. Nat. Sci. Philad., 1864, 109; Journ. of same; Obs., XI. 133, Pl. XXIV. Fig. 105. — Tryon, Am. Journ. Conch., II. 239 (1866).

I have not seen this species. The original description and a fac-simile of the original figure are given here. See also L. & Fr.-W. Sh., I. 260 (1869).

Spurious Species of Helicidæ.

Bulimus (*Partula*) *Bataviæ*, var. *β. minor.* United States, Grateloup (Soc. Lin. de Bord., XI. 165).

Partula Otaheitana, Fér. United States (Grateloup, l. c. p. 426).

Agatina fuscata, RAFINESQUE, is probably not found in the United States. (See Terr. Moll., I. 50.) See also ante, p. 410.

To the Terrestrial Mollusks, I. p. 348, *et seq.*, and IV. p. 152,[1] I refer for information regarding the following species of RAFINESQUE : —

Zolotrema, RAF.
Hemiloma ovata, RAF.
Menomphis, RAF.
Aplodon nodosum, RAF.
Chimotrema planiuscula, RAF.
Hemiloma avara, RAF.
Mesodon maculata, RAF.
Mesomphix, RAF.
Odomphium, RAF.
Odotropis, RAF.
Omphalina, RAF.
Omphalina cuprea, RAF.
Stenostoma convexa, RAF.
Stenotrema convexa, RAF.
Toxostoma globularis, RAF.
Toxotrema globularis, RAF.
Toxotrema complanata, RAF.
Triodopsis lunula, RAF.
Trophodon, RAF.
Xolotrema lunula, RAF.
Xolotrema triodopsis, RAF.

Oxyurus quadrilus, RAF., is a typographical error of my own in my "Notes," No. 4. No such name was proposed by him.

FOSSIL HELICIDÆ.

Anomphalus Meekii, BRADLEY. Coal of Illinois. See Am. Journ. of Science, August, 1872.

Cœlocentrum irregulare, GABB. (see L. & Fr.-W. Sh., I. 23), and *Berendtia Taylori*, PFR. (see same, 189). Lower California species are said to have been found fossil at Carson Valley, Nevada, latitude 39°, by Dr. J. G. COOPER, Am. Journ. Conch., IV. 217.

VIII. SUPPLEMENT.

Zonites Whitneyi. (See p. 113.) There are 24—1—24 teeth on the lingual membrane, all of the usual type ; four of them are laterals.

Mesodon devia. (See p. 337.) The typical form has the same type of dentition as the Salmon River variety. It is figured on Pl. XVI. Fig. S. There are 28—1—28 teeth. The thirteenth lateral has its inner cutting cusp split. The jaw has fourteen ribs. The genital system has a small, globular genital bladder on a long stout duct, which tapers greatly towards the bladder. The penis sac is stout, long, cylindrical, with both vas deferens and retractor muscle entering its apex; the ovary is long and narrow. There are no accessory organs.

I am indebted to Mr. Henry Hemphill for the opportunity of examining the above species.

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[1] See also BINNEY'S and TRYON'S ed. of RAFINESQUE'S Complete Writings.

IX. INDEX.

N. B. — When there are only a few species in a genus, the generic name alone is given below.

ACANTHINULA, 341. *See* Helix.
Achatina acicula, 190.
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  bullata, 87.
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  fasciata, 404.
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AT

HARVARD COLLEGE, IN CAMBRIDGE.

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PLATES.

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THE TERRESTRIAL
AIR-BREATHING MOLLUSKS

OF THE

UNITED STATES AND THE ADJACENT TERRITORIES
OF NORTH AMERICA.

DESCRIBED AND ILLUSTRATED

BY W. G. BINNEY.

VOL. V.

PLATES.

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X. EXPLANATION OF PLATES OF VOL. III.

For the lettering of the plates of Vol. III. the following is to be substituted.

Plate I. Mesodon major.
II. albolabris.
III. multilineata.
IV. clausa (middle line).
Mitchelliana (outline figures).
V. Columbiana.
VI. Arionta intercisa (central figure).
Californiensis (outer figures).
redimita (upper and lower figures).
VI. a. Nickliniana.
VII. Mesodon Pennsylvanica.
VIII. Tachea hortensis.
IX. Mesodon elevata.
X. exoleta.
XI. thyroides.
XI. a. " var. bucculenta.
XII. dentifera.
XIII. Triodopsis appressa.
XIII. a. Mesodon Columbiana (*labiosa*) Fig. 1.
divesta (Fig. 2).
XIV. Triodopsis palliata.
XV. obstricta.
XVI. Arionta tudiculata.
XVII. Fig. 1. Vallonia pulchella.
2. Zonites minusculus.
3. Strobila labyrinthica.
4. Zonites fulvus.
XVIII. Aglaja fidelis.
XIX. Arionta Townsendiana.
XX. Macrocyclis Vancouverensis.
XXI. concava.
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Fig. 3. Gundlachi.
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XXV. Patula alternata.
XXVI. Cumberlandiana.
XXVI. a. strigosa.
XXVII. Triodopsis tridentata.
XXVIII. fallax.
XXIX. Fig. 1. Zonites viridulus.
Fig. 2. indentatus.
Fig. 3. arboreus.
Fig. 4. cellarius.
XXIX. a. There are two plates of this. That engraved by Delarue is as follows: —
Fig. 1. Triodopsis loricata.
Fig. 2. Zonites capsella.
Fig. 3. Ottonis (= arboreus).
Fig. 4. Microphysa incrustata.
The other, engraved by Duthie, has
Fig. 1. Zonites capsella.
Fig. 2. Microphysa vortex. Other figures as in the Delarue plate.
XXX. Fig. 1. Patula perspectiva.
Fig. 2. striatella.
Fig. 3. Zonites limatulus.
Fig. 4. internus.
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XXXII. lævigatus.
XXXIII. subplanus.
XXXIV. inornatus.
XXXV. ligerus.
XXXVI. intertextus.
XXXVII. Fig. 1. Zonites suppressus.
Fig. 2. lasmodon.
Fig. 3, 4. gularis.
XXXVIII. Polygyra septemvolva. The outer figures are var. volvoxis.
XXXIX. Fig. 1. Polygyra septemvolva, var. volvoxis.
Fig. 2. Troostiana.
Fig. 3. pustula.
Fig. 4. fastigans.
XL. Fig. 1. Left hand, Polygyra auriculata.
Right hand, auriformis.
Fig. 2. Polygyra auriformis.
XL. a, Fig. 1. Polygyra leporina.
Fig. 2. Stenotrema maxillatum. N. B. The enlarged view of the aperture is misplaced with Fig. 3 on the plate engraved by Delarue. It is correctly placed on that engraved by Duthie, there being two plates of XL. a.
Fig. 3. Stenotrema germanum.
Fig. 4. Polygyra vultuosa.
XLI. Stenotrema monodon. The upper transverse line represents the variety FRATERNA, the two central transverse lines the var. Leaii.

XLII. Fig. 1. Zonites demissus.
Fig. 2. Mesodon jejuna.
Fig. 3. Stenotrema hirsutum.
Fig. 4. stenotrema.
XLIII. Pomatia Buffoniana : a Mexican species omitted from this volume. See Vol. II.
XLIV. Fig. 1. Stenotrema spinosum.
Fig. 2. Edgarianum.
XLV. Fig. 1. Polygyra Texasiana.
Fig. 2, 3. Triodopsis inflecta.
XLVI. Hemitrochus varians, var. ζ, η, θ. ι.
XLVII. α, β, γ, δ, ε.
XLVIII. Fig. 1. Helicodiscus lineatus.
Fig. 2. Zonites vortex.
Fig. 3. multidentatus.
XLIX. Fig. 1. Dorcasia Berlandieriana.
Fig. 2. griseola.
L. Fig. 1. Stenogyra decollata.
Fig. 2. Bulimulus serperastus.
LI. Fig. 1. dealbatus.
Fig. 2. Schiedeanus.
LI. a. alternatus, upper and lower figures.
dealbatus, middle transverse line of figures.
LI. b. alternatus.
LII. Fig. 1. Pupa fallax.
Fig. 2. modica.
Fig. 3. Acantinula harpa.
Fig. 4. Ferussacia subcylindrica.
LIII. Fig. 1. Carychium exiguum, a species of Limnophila, omitted from this volume. See Vol. IV.
Fig. 2. Blauneria pellucida. See Vol. IV.
Fig. 3. Stenogyra gracillima.
Fig. 4. octonoides.
LIV. Orthalicus undatus.
LV. Liguus fasciatus.
LVI. "
LVII. "
LVIII. Bulimulus multilineatus.
LIX. Glandina truncata.
LX. "
LXI. Fig. 1. Glandina decussata.
Fig. 2. truncata var.
LXII. Fig. 1. Vanuxemensis.
Fig. 2. truncata var.
LXII. a. bullata.
LXIII. Fig. 1, 2. Tebennophorus Caroliniensis.
Fig. 3. Pallifera dorsalis.
LXIV. Fig. 1. Arion fuscus.

Fig. 2. Limax agrestis.
Fig. 3. campestris.
LXV. Fig. 1. flavus — with eggs.
Fig. 2. Arion fuscus.
LXVI. Fig. 1. Ariolimax Columbianus, with the internal plate, head, and mantle.
Fig. 2. Arion foliolatus with the surface enlarged. Not an Arion. See p. 225.
LXVII. Veronicella Floridana.
LXVII. a. Fig. 1. Vitrina limpida.
Fig. 2. Succinea Concordialis.
Fig. 3. ovalis, Gld., not of Say.
Fig. 4. Nuttalliana.
LXVII. b. Fig. 1. Succinea campestris.
Fig. 2. Totteniana.
Fig. 3. obliqua.
LXVII. c. Fig. 1. luteola.
Fig. 2. aurea.
Fig. 3. Orĕgonensis.
Fig. 4. avara.
LXVIII. Strophia incana.
LXIX. Fig. 1. Macroceramus Kieneri: the outline natural size.
Fig. 2. Cylindrella Poeyana, with enlarged view of aperture and apicial whorls.
Fig. 3. Cylindrella jejuna.
LXX. Fig. 1. Pupa rupicola.
Fig. 2. contracta.
Fig. 3. muscorum.
Fig. 4. armifera.
LXXI. Fig. 1. Vertigo milium.
Fig 2. Gouldi.
Fig. 3. Pupa decora.
Fig. 4. Vertigo modesta = ovata.
LXXII. Fig. 1. Pupa pentodon.
Fig. 2. variolosa.
Fig. 3. Vertigo simplex.
Fig. 4. Pupa corticaria.
LXXII. a. Chondropoma dentatum. A pectinate species not included in this volume. See Vol. IV.
LXXIII. Helicina orbiculata: the lower line is Hel. tropica. See Pl. LXXII. a.
LXXIV. Fig. 1. Helicina occulta (recent). See Pl. LXXII. a.
Fig. 2. " (fossil).
Fig. 3. orbiculata.
Fig. 4. chryosocheila.

XI. EXPLANATION OF PLATES OF VOL. V.

PLATE I.

Lingual dentition of

A. Glandina truncata.
B. Macrocyclis Vancouverensis.
C. concava.
D. Voyana.
E. Duranti.
F. Limax maximus.
  b. inner marginals.
  c. outer marginals.
G. Limax flavus.
H. agrestis.
I. campestris.
J. Hewstoni.
K. montanus, var. castaneus.
L. occidentalis (see p. 149).

PLATE II.

Central, lateral, and marginal teeth of

A. Vitrina Pfeifferi.
B. exilis.
C. limpida.
D. Zonites Gundlachi.
E. fulvus.
F. lævigatus.
G. cellarius.
H. inornatus.
I. Zonites fuliginosus.
J. friabilis.
K. capnodes.
L. intertextus.
M. ligerus.
N. limatulus.
O. demissus.
P. sculptilis.

PLATE III.

Lingual dentition of

A. Zonites nitidus.
B. cerinoideus.
C. Elliotti.
D. exiguus.
E. viridulus.
F. arboreus.
G. indentatus.
H. minusculus.
I. Binneyanus.
J. suppressus.
K. gularis.
L. Zonites placentula.
M. milium.
N. multidentatus.
O. lasmodon.
P. ferreus.
Q. internus.
R. significans.
S. Microphysa incrustata.
T. vortex.
U. Ingersolli.

PLATE IV.

Lingual dentition of

A. Patula perspectiva.
B. striatella.
C. Patula asteriscus.
D. Cumberlandiana.

E. Patula alternata.
F. mordax.
G. Cooperi.
H. strigosa.
I. Idahoensis.
J. Hemphilli.
K. solitaria.
L. Hemitrochus varians.
M. Helicodiscus lineatus.
N. Holospira Goldfussi.
O. Tebennophorus Caroliniensis.
P. Stenogyra subula.
Q. decollata.
R. Ferussacia subcylindrica.
S. Pupa rupicola.
T. fallax.

PLATE V.

Lingual dentition of

A. Strophia incana.
B. Onchidella borealis.
C. Arion fuscus.
D. Ariolimax niger.
E. Columbianus.
F. Californicus.
G. Andersoni.
H. Hemphilli.
I. Prophysaon Hemphilli.
J. Hemphillia glandulosa.
K. Binneya notabilis.
L. Pallifera dorsalis.
M. Wetherbyi.
N. Acanthinula Hubbardi.
O. labyrinthica.
P. Veronicella Floridana.
Q. Gonostoma Yatesi.

PLATE VI.

Lingual dentition of

A. Polygyra auriculata.
B. uvulifera.
C. pustuloides.
D. Troostiana.
E. pustula.
F. leporina.
G. Texasiana.
H. fastigans.
I. Dorfeuilliana.
J. Polygyra Febigeri.
K. cereolus.
L. septemvolva.
M. Carpenteriana.
N. Postelliana.
O. Hazardi.
P. espiloca.
Q. Mooreana.
R. auriformis.

PLATE VII.

Lingual dentition of

A. Polygyrella polygyrella.
B. Stenotrema spinosum.
C. barbigerum.
D. Edvardsi.
E. stenotremum.
F. hirsutum.
G. germanum.
H. monodon.
I. Triodopsis Van Nostrandi.
J. loricata.
K. Rugeli.
L. Triodopsis fallax.
M. tridentata.
N. Hopetonensis.
O. palliata.
P. obstricta.
Q. appressa.
R. Harfordiana.
S. inflecta.
T. Turricula terrestris.
U. Vallonia pulchella.
V. Dorcasia griseola.

Plate VIII.

Lingual dentition of

A. Mesodon exoleta.
B. Sayii.
C. Roemeri.
D. Wetherbyi.
E. Pennsylvanica.
F. Downieana.
G. major.
H. Mitchelliana.
I. Clarki.
J. dentifera.
K. Mesodon albolabris.
L. multilineata.
M. elevata.
N. Mobiliana.
O. devia, from Salmon River.
P. Columbiana.
Q. profunda.
R. Wheatleyi.
S. thyroides.
T. clausa.

Plate IX.

Lingual dentition of

A. Fruticicola rufescens.
B. Aglaja infumata.
C fidelis.
D. Arionta arrosa.
E. tudiculata.
F. Nickliniana.
G. redimita.
H. Ayresiana.
I. Kelletti.
J. sequoicola.
K. ramentosa.
L. Arionta Stearnsiana.
M. Traski.
N. ruficincta.
O. exarata.
P. facta.
Q. Townsendiana.
R. Dupetithouarsi.
S. Californiensis.
T. Diabloensis.
U. Carpenteri.

Plate X.

Lingual dentition of

A. Glyptostoma Newberryanum.
B. Euparypha Tryoni.
C. Tachea hortensis.
D. Pomatia aspersa.
E. Bulimulus dealbatus.
F. Dormani.
G. Liguus fasciatus.
H. Orthalicus undatus.
I. Succinea Sillimani.
J. Succinea Stretchiana.
K. avara.
L. lineata.
M. ovalis.
N. effusa.
O. campestris.
P. obliqua.
Q. Macroceramus Gossei.
R. Cylindrella Poeyana.

Plate XI.

In all the figures of genitalia, the penis sac (p. s.) is represented in its natural position to the left; the genital bladder (g. b.) with its duct (d. g. b.) to the right of the system. They can readily be distinguished without being indicated by lettering. The same may be said of the testicle (t.), epididymis (ep.), accessory gland, (a. g.) prostate (p.), vas deferens (v. d.), retractor of penis sac (r.), ovary (o.), oviduct (ov.), vagina (v.), external orifice (or.). These are, however, all indicated by their initial letters in Fig. A. The accessory organs when present are all indicated by their initial letters, accessory duct (a. d.), prostate gland (pr. g.), dart sac (d. s.), prepuce (pp.), flagellum (fl.), accessory gland (a. g).

Genitalia of

Fig. A. Patula strigosa.
Fig. B. Binneya notabilis.
Fig. C. Zonites inornatus.
Fig. D. friabilis.
Fig. E. lævigatus.
Fig. F. Limax Hewstoni.
Fig. G. Mesodon Clarki.

Fig. H. Mesodon Mitchelliana.
Fig. I. Columbiana.
Fig. J. Roemeri.
Fig. K. Triodopsis appressa.
Fig. L. Stenotrema monodon.
Fig. M. germanum.

PLATE XII.

Genitalia of (see description of Plate XI.)

Fig. A. Limax maximus.
Fig. B. montanus.
Fig. C. Ariolimax Columbianus.
Fig. D. Californicus.
Fig. E. Andersoni.
Fig. F. niger.

Fig. G. Ariolimax Hemphilli.
Fig. H. Prophysaon Hemphilli.
Fig. I. var.
Fig. J – K. Hemphillia glandulosa.
χ (see description p. 249).
Fig. L. Macrocyclis Vanconverensis.

PLATE XIII.

Genitalia of (see description of Plate XI.)

Fig. A. Arionta sequoicola.
χ (see description, p. 368).
Fig. B. Arionta Stearnsiana.
Fig. C. Nickliniana.
Fig. D. Kelletti.
Fig. E. Mormonum.
γ, dart sac.
a. pr. g., accessory prostate gland.
χ (see description, p. 367).

Fig. F. Same: dart.
Fig. G. Same· concretions (see p. 367.)
Fig. H. Arionta Traski.
Vaginal prostate: χ, bulb of same.
Fig. I. Arionta arrosa.

PLATE XIV.

Genitalia of (see description of Plate XI.)

Fig. A. Arionta Townsendiana.
Fig. B. ruficincta.
Fig. C. Euparypha Tryoni.
1, 2, 3 (see description, p. 377).
Fig. D. Glyptostoma Newberryanum.

Fig. E. Aglaja fidelis.
Fig. F. infumata
Fig. G. Mesodon clausa.
Fig. H. Stenotrema spinosum.

PLATE XV.

Genitalia of (see description of Plate XI.)

Fig. A. Triodopsis Hopetonensis.
Fig. B. fallax.

Fig. C. Triodopsis Van Nostrandi.
Fig. D. tridentata.

Fig. E. Triodopsis Rugeli.
Fig. F. inflecta.
Fig. G. Mesodon Pennsylvanica.
Fig. H. Polygyra septemvolva.
Fig. I. Polygyra Troostiana.
Fig. J. Bulimulus Dormani.

Dentition of

Fig. K. Macrocyclis sportella.
Fig. L. Polygyra avara.
Fig. M. Turricula terrestris.
Fig. N. Arionta ptychophora.

Genitalia of

Fig. O. Arionta ruficincta.

Dentition of

Fig. P. A. Mormonum.

PLATE XVI.

Central, lateral, transition, and marginal teeth of

Fig. A. Patula Hemphilli.
B. P. Haydeni.
C. Triodopsis introferens, and profile.
D. Polygyra oppilata.
E. Mesodon Christyi.
F. Succinea Nuttaliana.

Jaw of

G. Patula Haydeni.
H. Vitrina limpida.

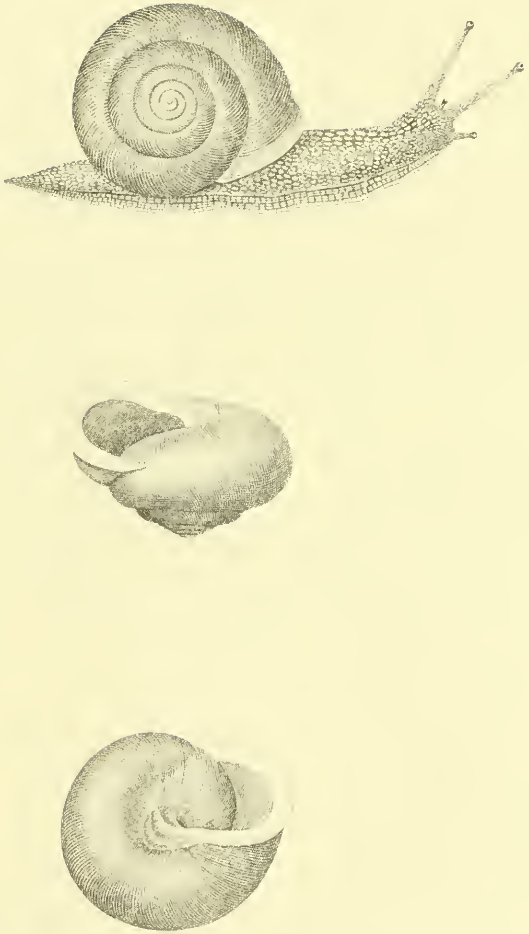
Lingual membrane greatly enlarged, with a line to show transverse row of teeth; the upper margin in the figure corresponding with the posterior margin of the membrane of

I. Holospira Goldfussi.
J. Glandina truncata.
K. Macrocyclis sportella.
L. Cylindrella Poeyana.
M. Orthalicus undatus
N. Onchidella borealis.
O. Macroceramus Gossei.
P. Veronicella Floridana.
Q. Mesodon albolabris.

Lingual dentition of

R. Succinea Haydeni.
S. Mesodon devia.
T. Stenotrema labrosum.
U. Mesodon divesta.

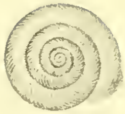
Helix major

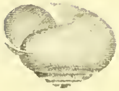


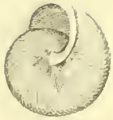
Helix albolabris

Helix multilineata, Say.

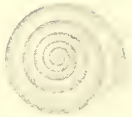
Sutton del

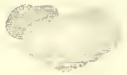


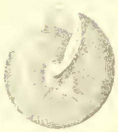




Helix clausa, Say







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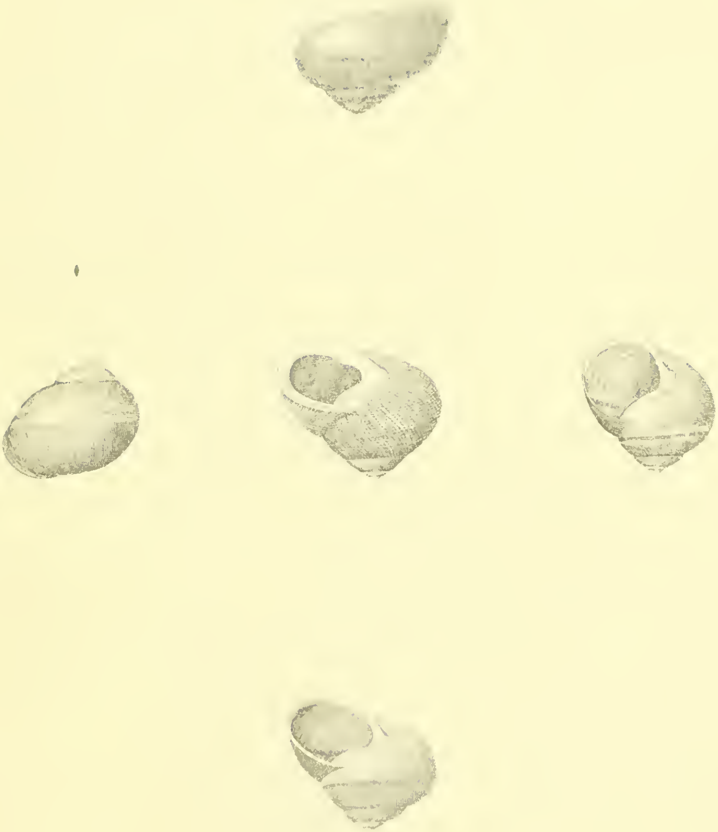
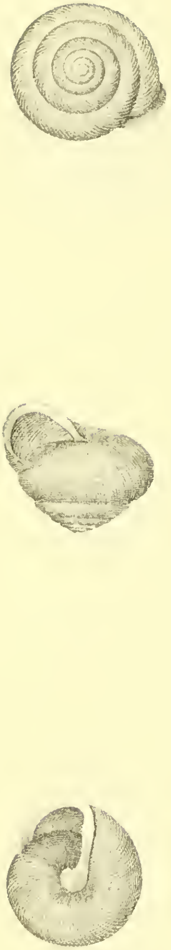
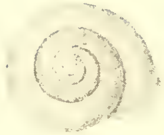


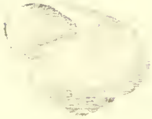
Helix Nickliniana, Lea.   *Helix Californiensis, Lea.*

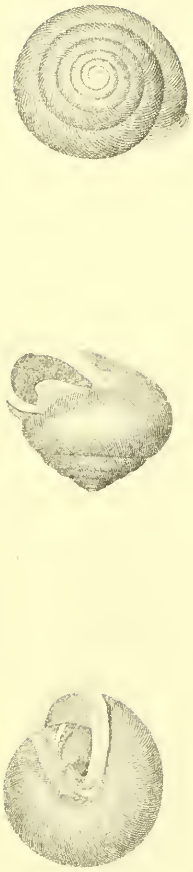
Helix nickliniana,



Helix Pennsylvanica, Say







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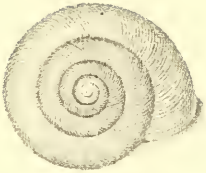

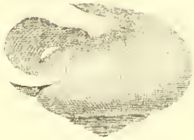

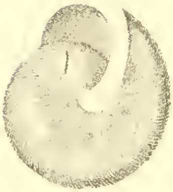

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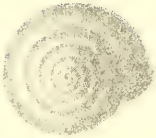

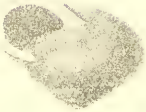

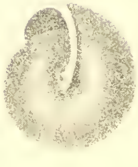

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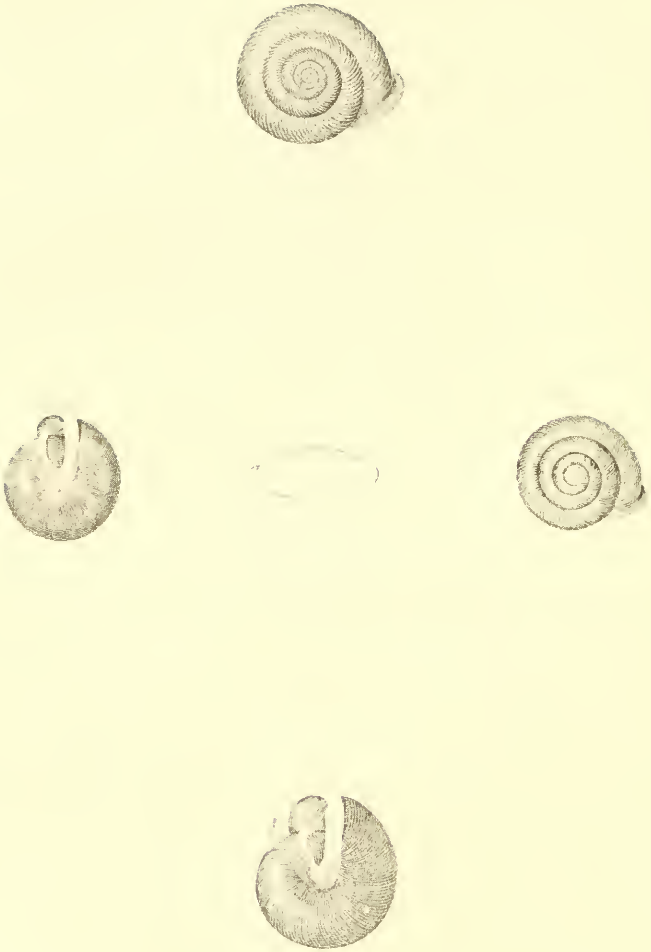
Helix dentifera



Helix appressa, Say

Pl. [illegible]

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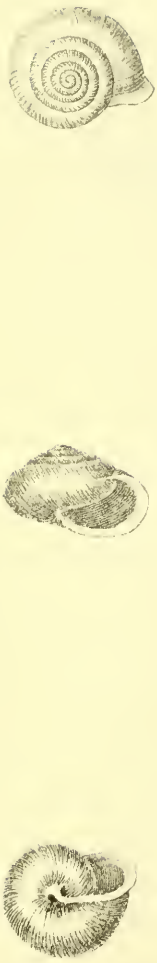

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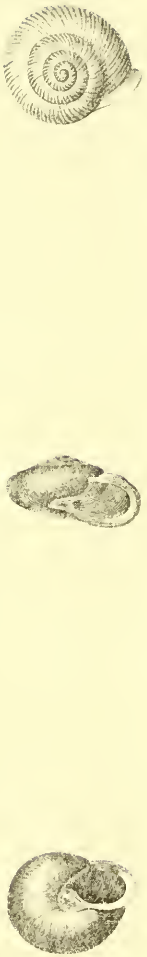
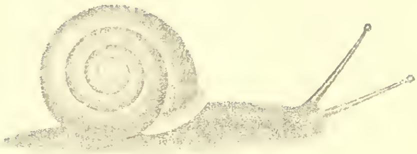
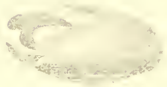


1 *Helix labiosa*, Gould 2 *Helix divesta*, Gould.





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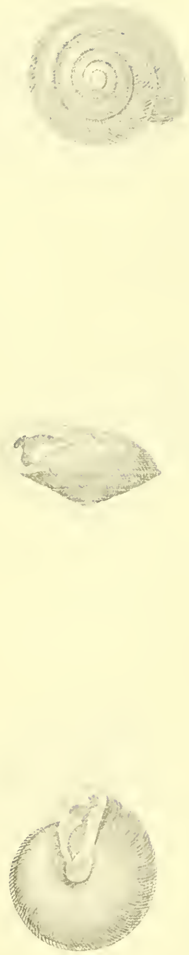

Helix palliata

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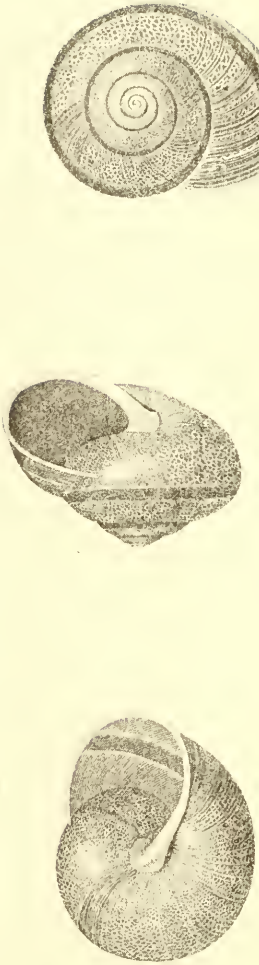
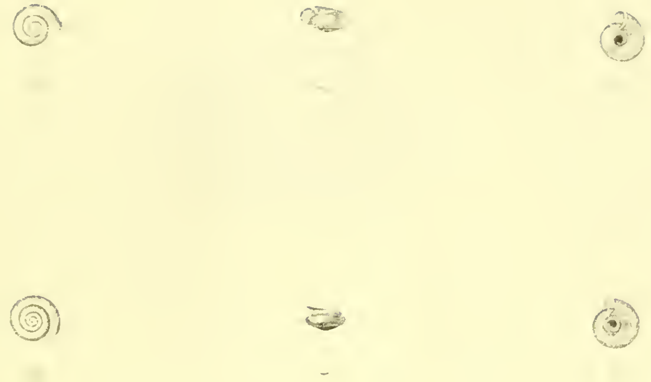
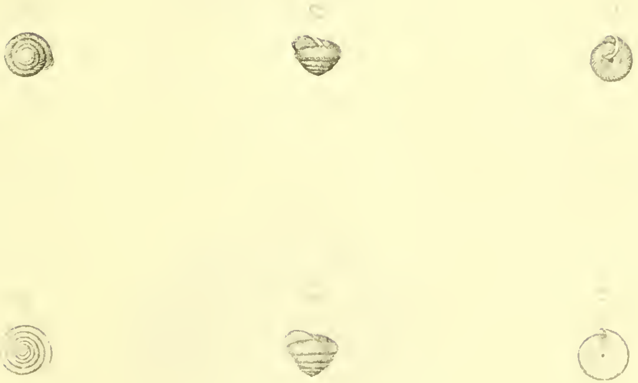
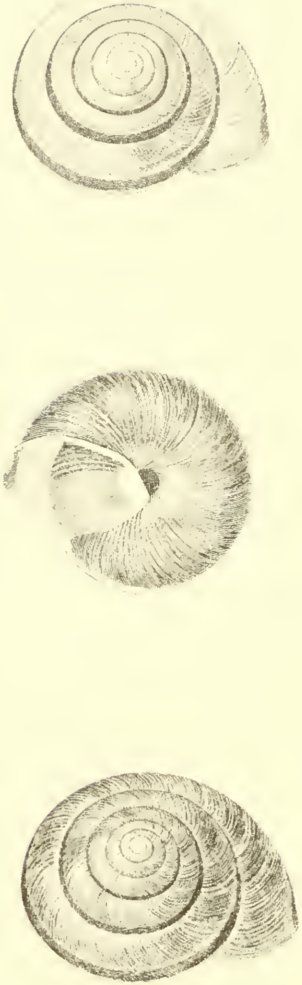




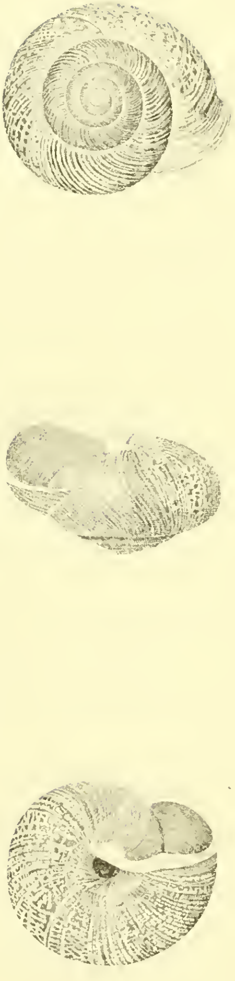


1. *Helix* [illegible]

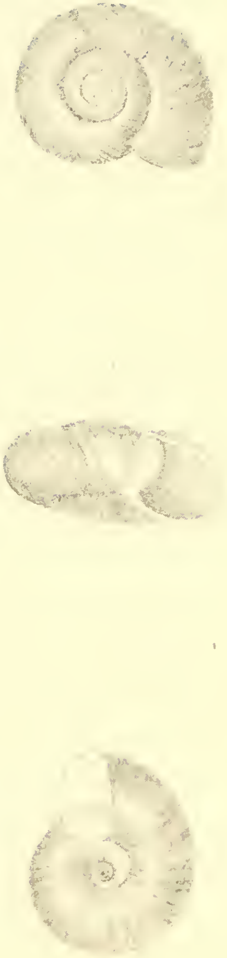
2. [illegible]



Helix Nuttalliana. Lea

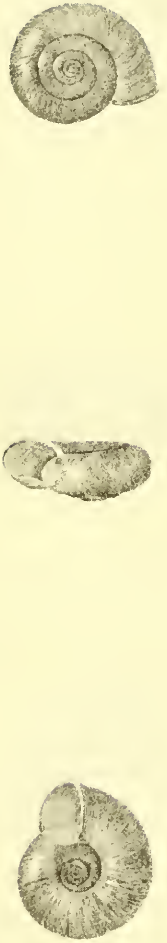


Helix Townsendiana. Lea



Helix lancerottensis

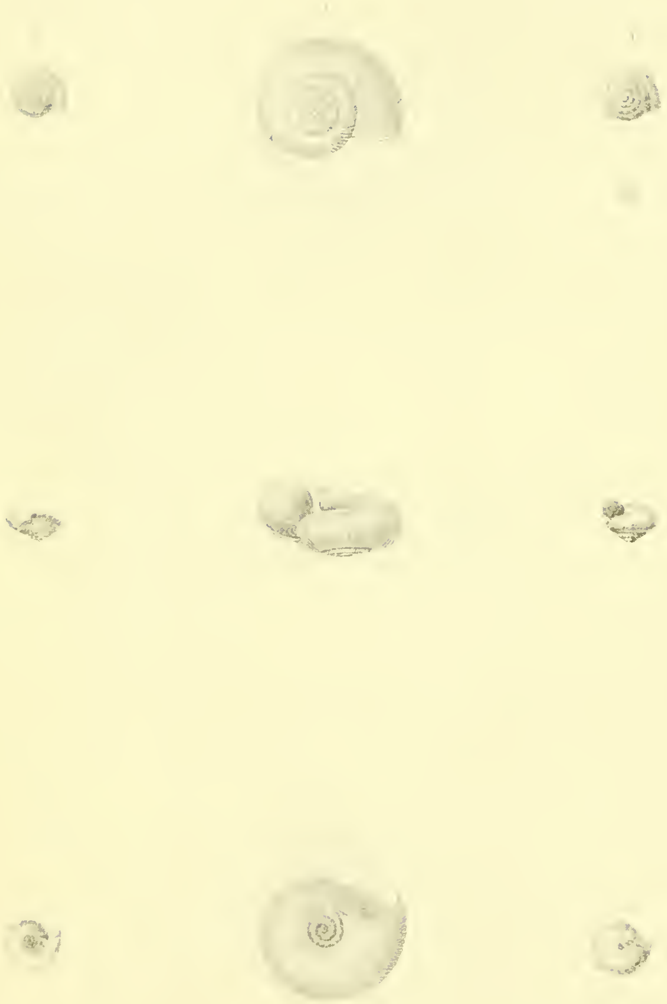
PL.XL



Helix concava, Say

Sutting del *W E Tucker S.*

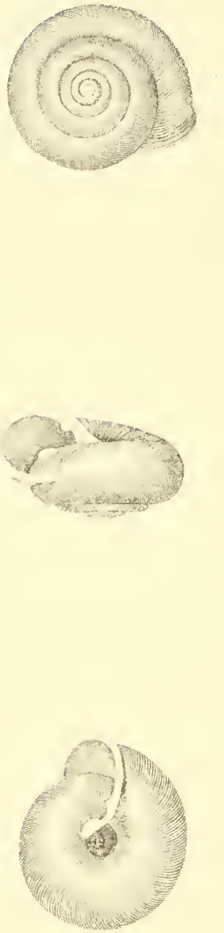
Helix pellicula [illegible]



1 Helix cyprella [illegible] 2 Helix [illegible] Mousson

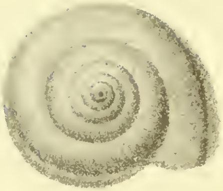
3 Helix cyprina id

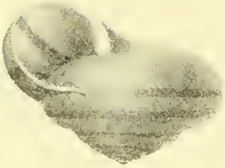
[illegible]

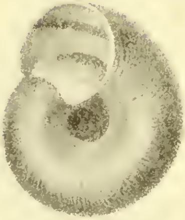


Helix Sayii

PL. XXIV

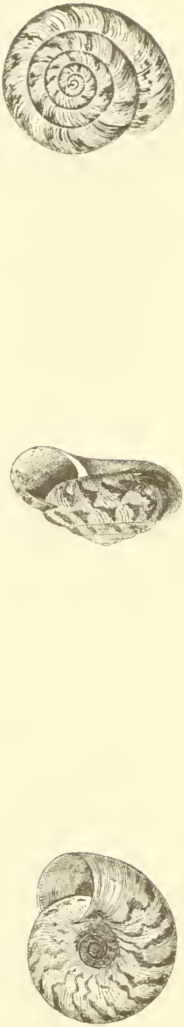




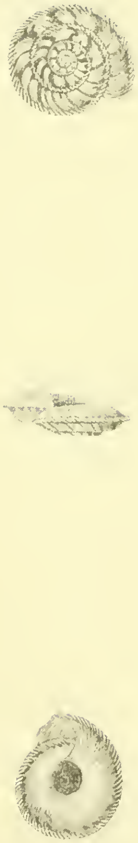


A. Meisel, Lith.

Pl. XXV.



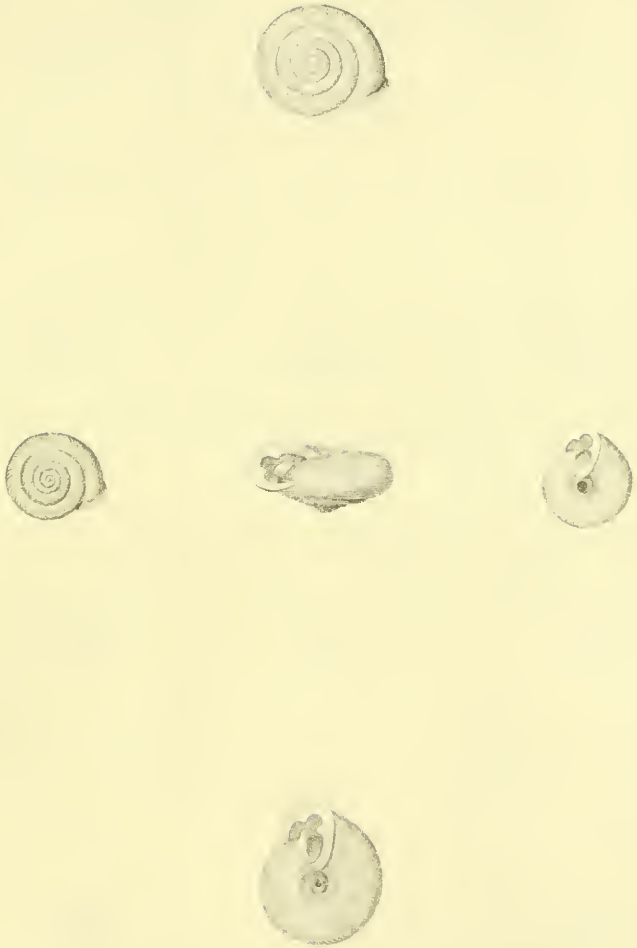
Helix alternata. -- Say.



Helix Cumberlandiana

Helix strigosa Gould

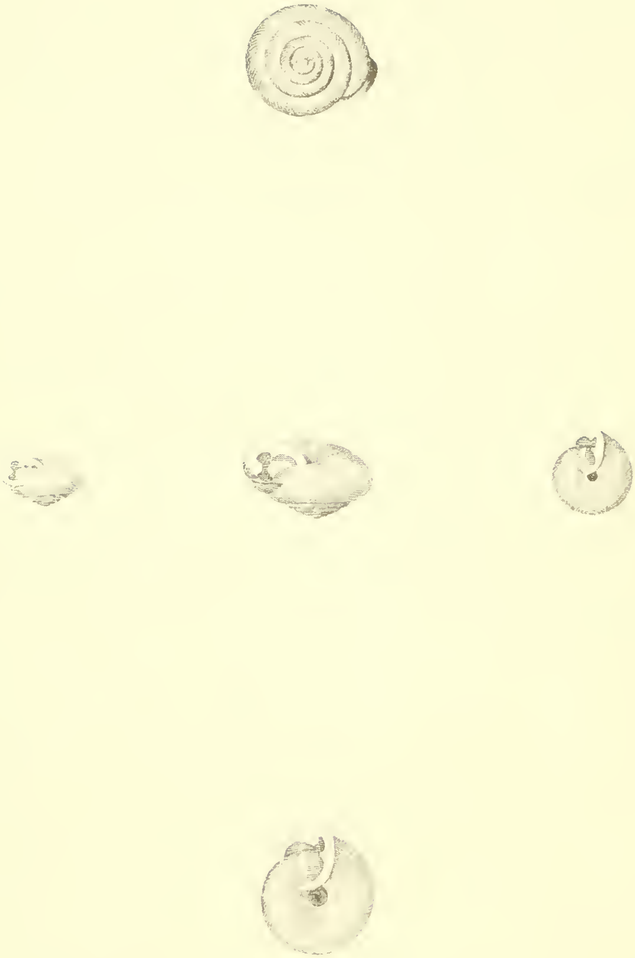
PL. XXVII.



Helix tridentata Say.

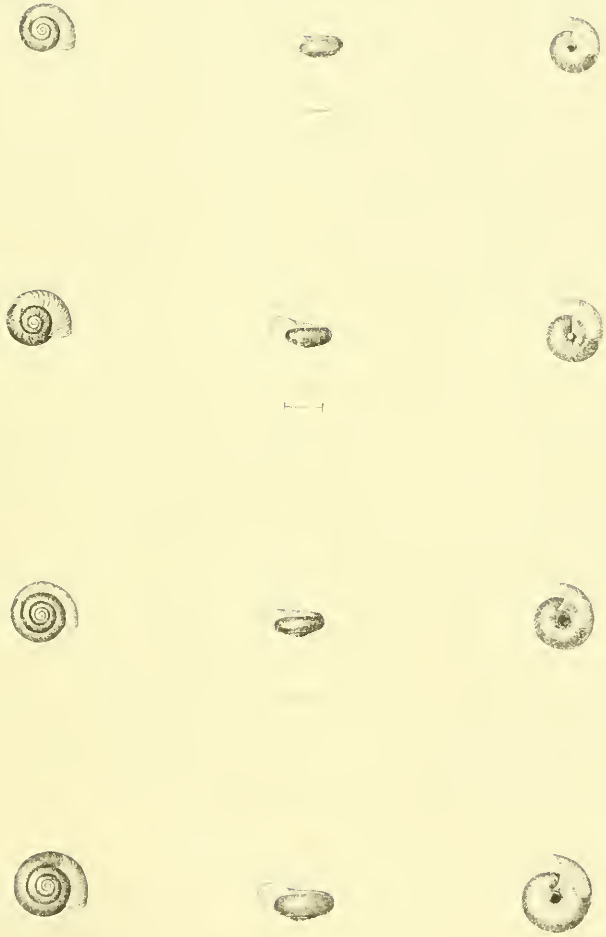
Sellers del

[illegible]



Helix tridentata [illegible]

[illegible]

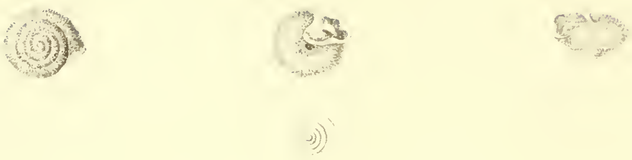


Helix electrina [illegible]
indentata [illegible]

Helix arborea [illegible]
cellaria [illegible]

Alex Lawson sc.

1



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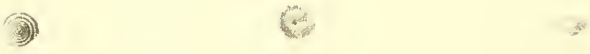


3

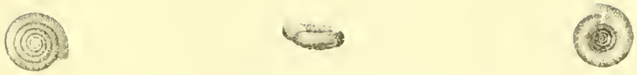
4

1 *H. loricata* 2 *H. capsella*

3 *H. ottonis* 4 *H. saxicolla*

Vve Delarue delt [illegible]

1.



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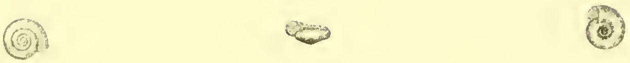

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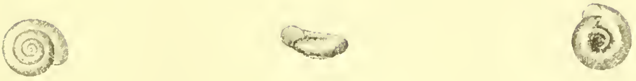
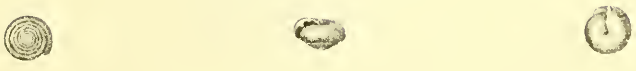


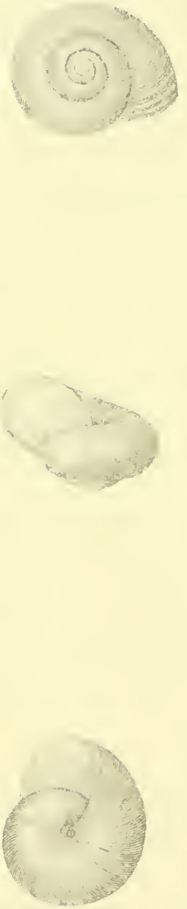
4.



1. Helix perspectiva Say.
2. — limatula. Binney.
3. Helix striatella Anth.
4. — interna Say.

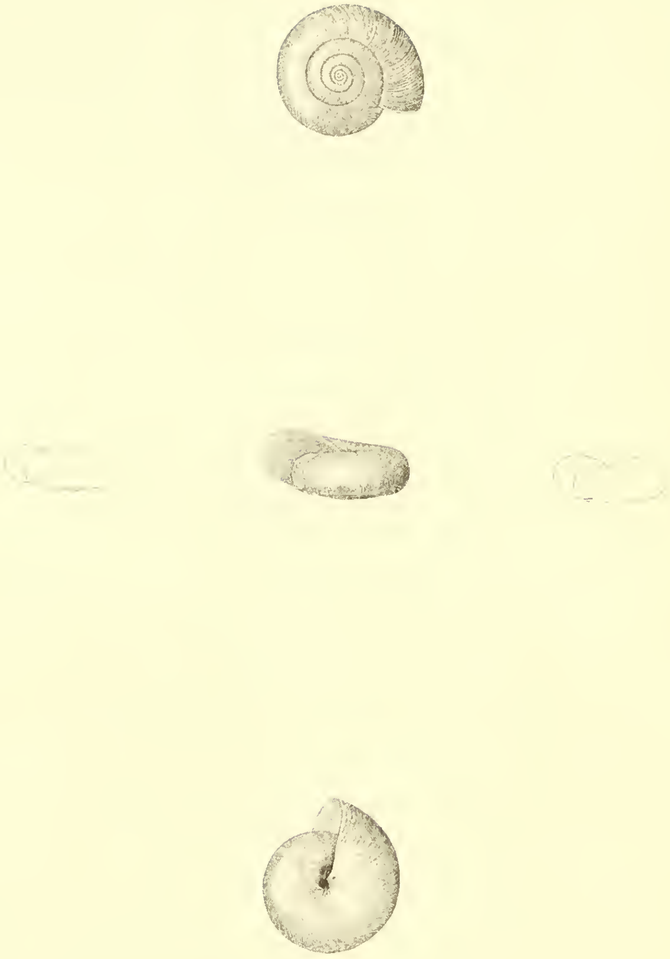
[illegible] del. [illegible]

Helix [illegible]



Helix lucubrata Say

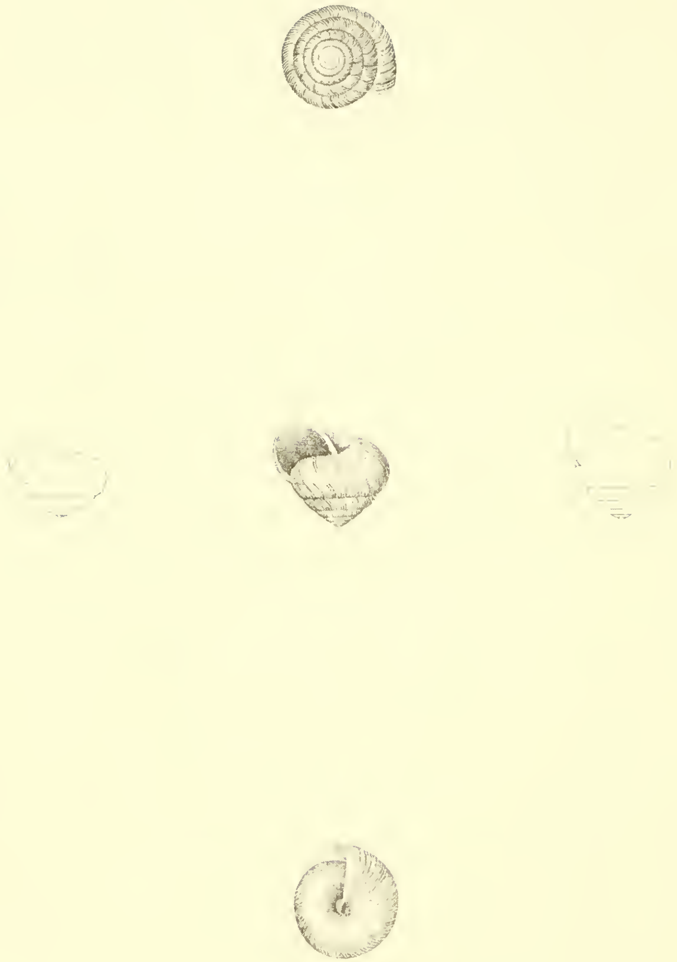
Pl. XXII



Helix subplana

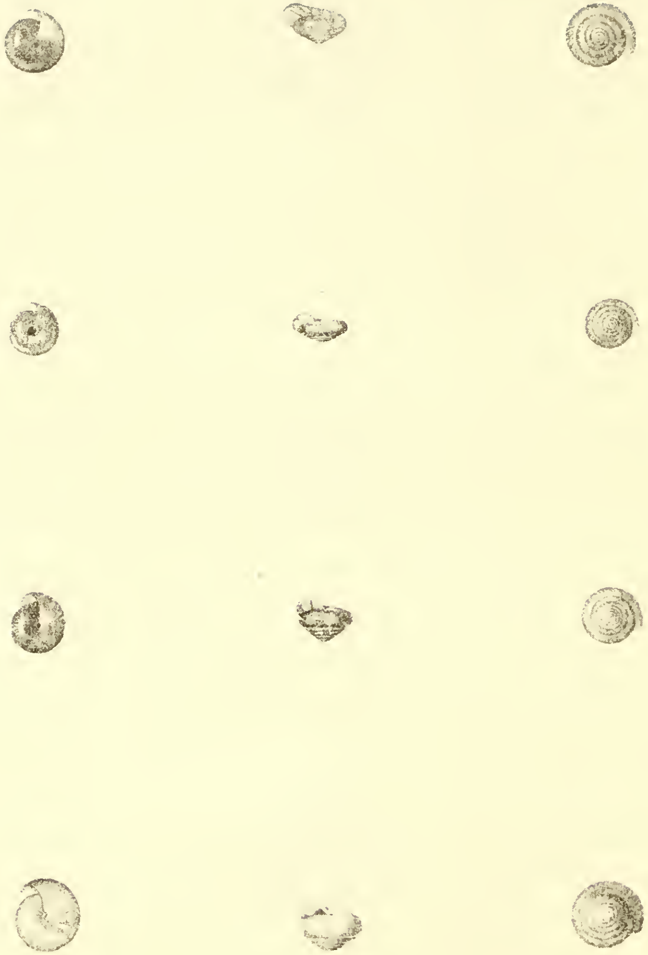
[illegible] [illegible]

Helix inornata ×6



Helix ligera.

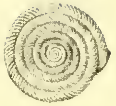
Helix intertexta.

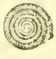


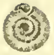
1 *Helix suppressa,* Say 2 *Helix lasmodon,* Phillips

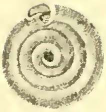
3 4 *Helix gularis,*_Say

Kutting del.



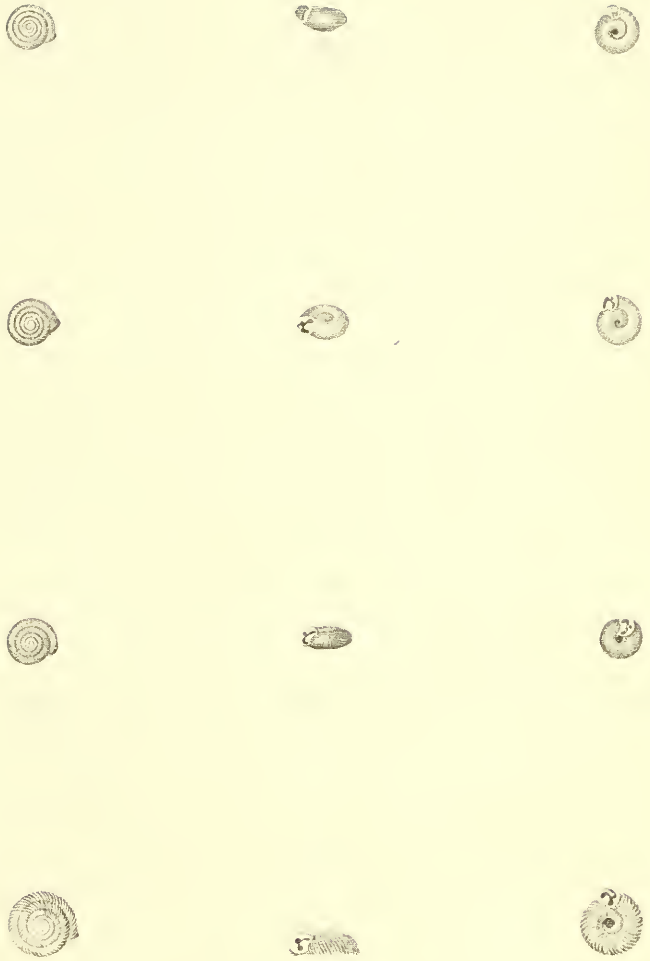






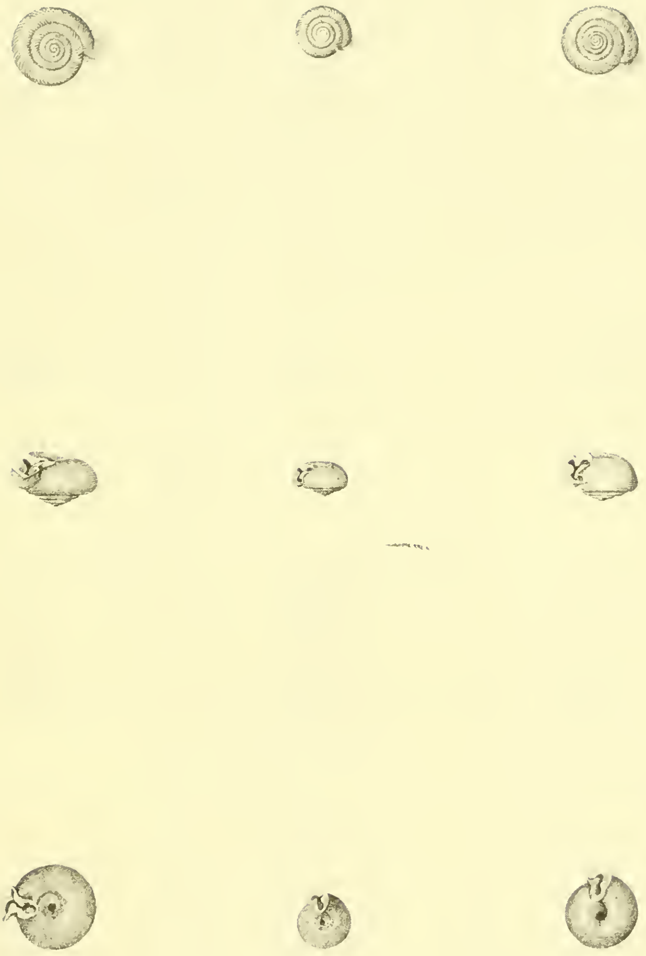
Helix Septemvolva Say.

Sutton del *Warren*

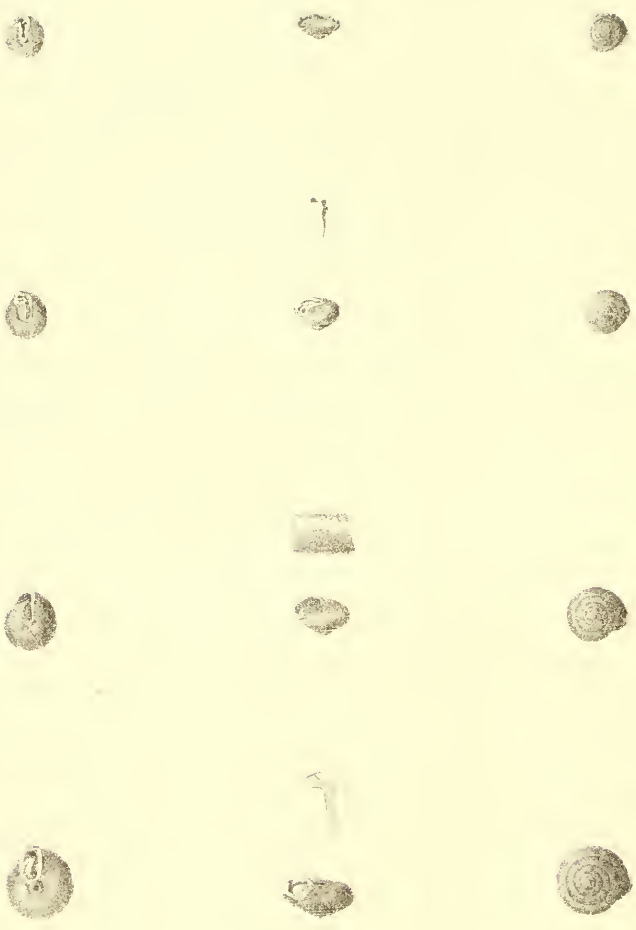


1. Helix Septemvolva Say
2. — plicata Say

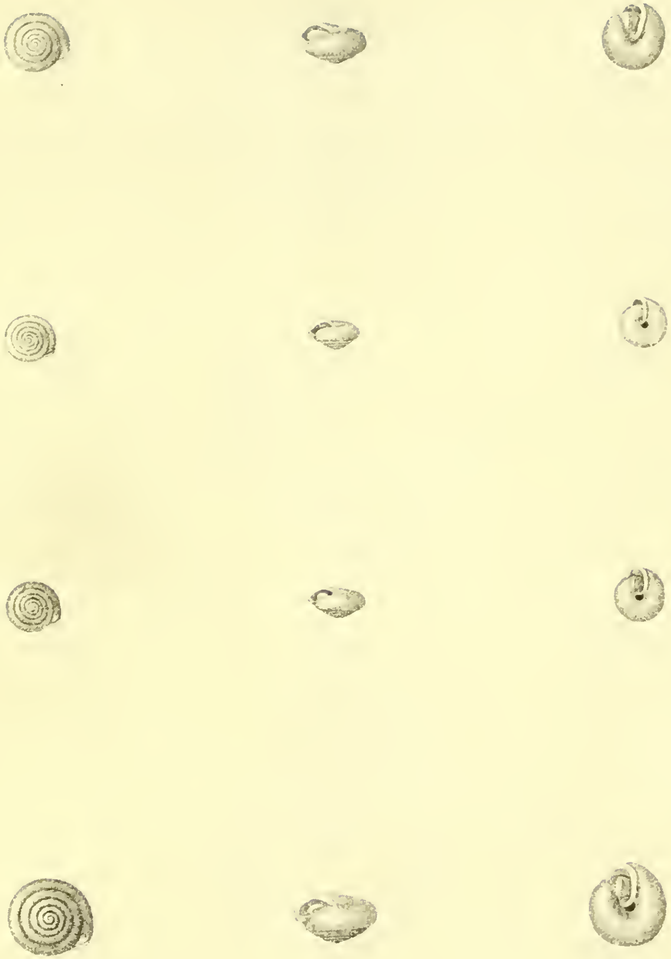
3. Helix [illegible]
4. — [illegible]



Helix auriculata.— Say
variety avara, Say.

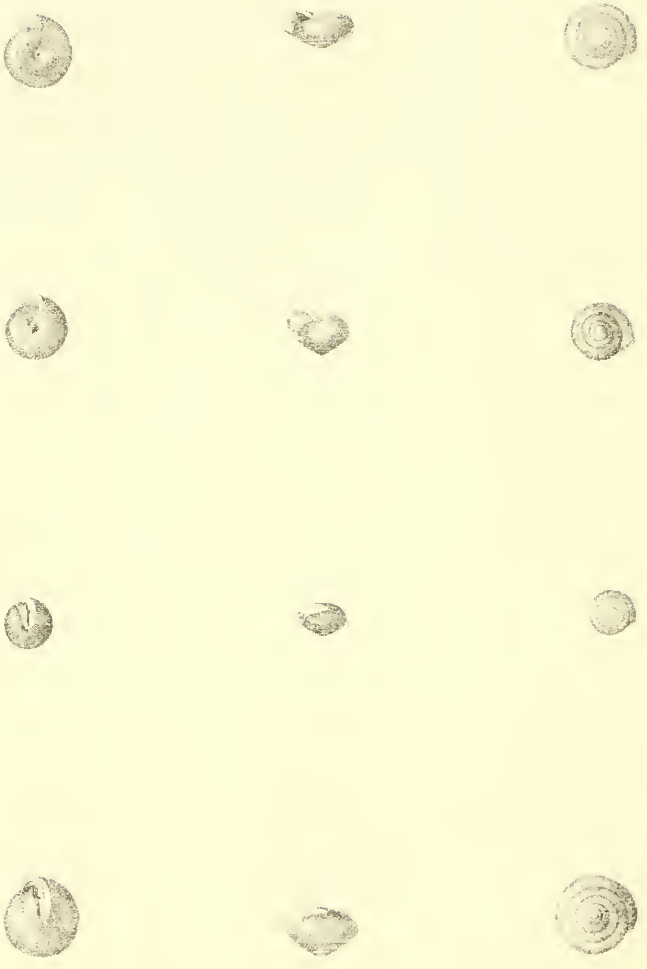


PL. X



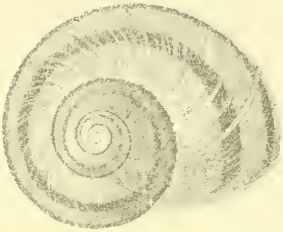
Helix monodon, Rackett

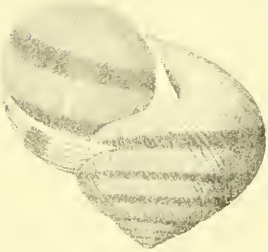
Miss [illegible] del

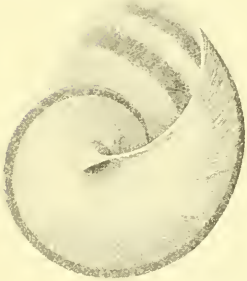


[illegible] [illegible] [illegible] [illegible]

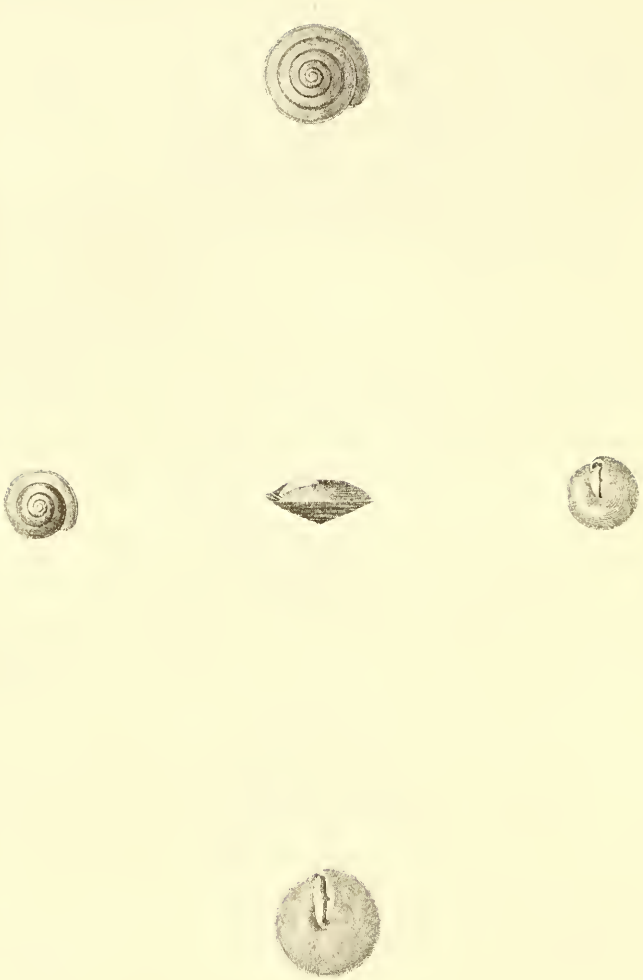
[illegible] [illegible]



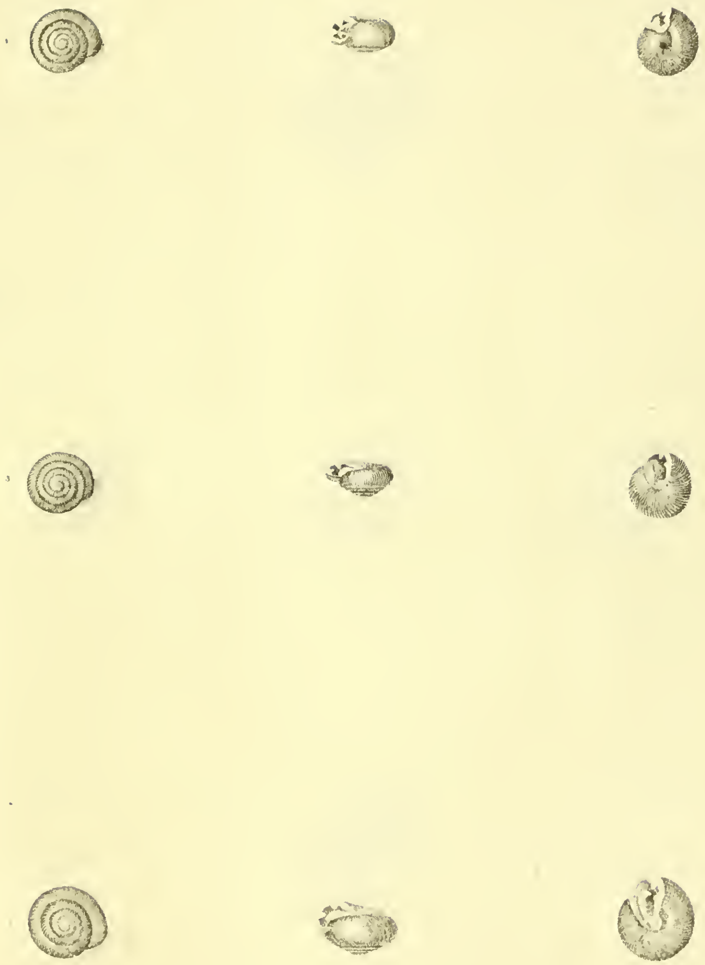




[illegible]



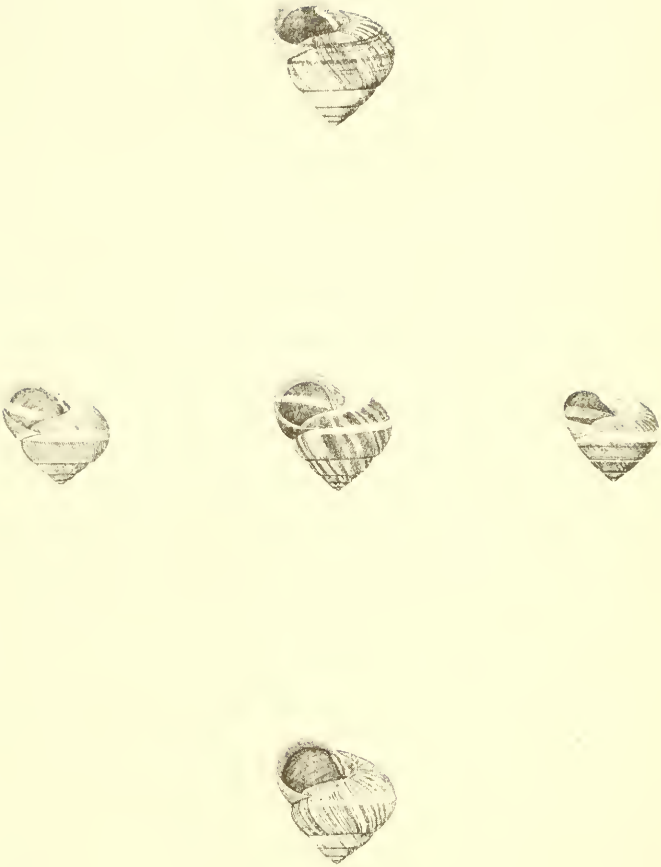
Helix spinosa
varet. edgariana



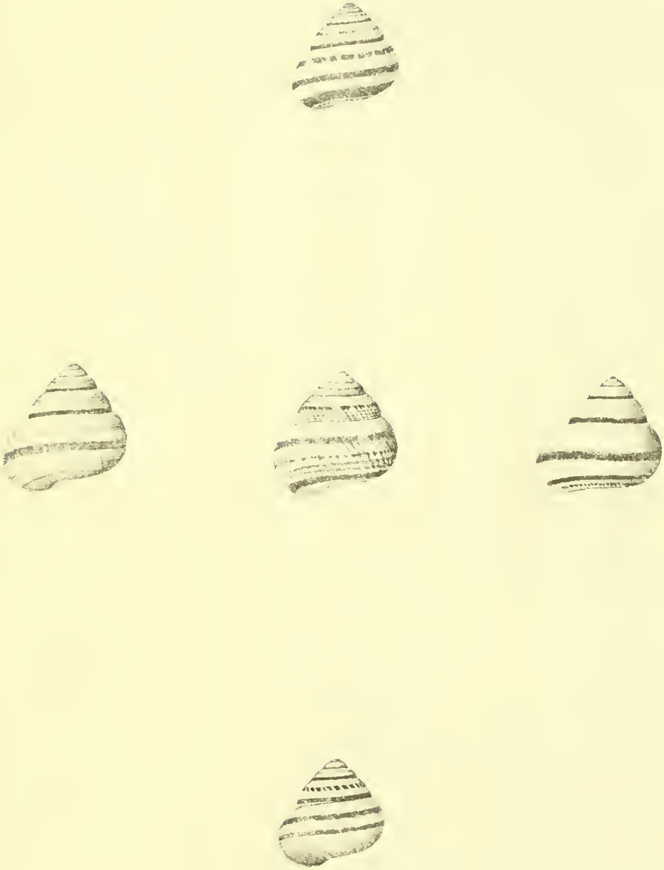
1 *Helix Texasiana*, Moricand

2 *H. inflecta*, Say 3 *H. inflecta*, Variety

[illegible] del. [illegible]



Helix rhodocheila



Helix rhodocheila

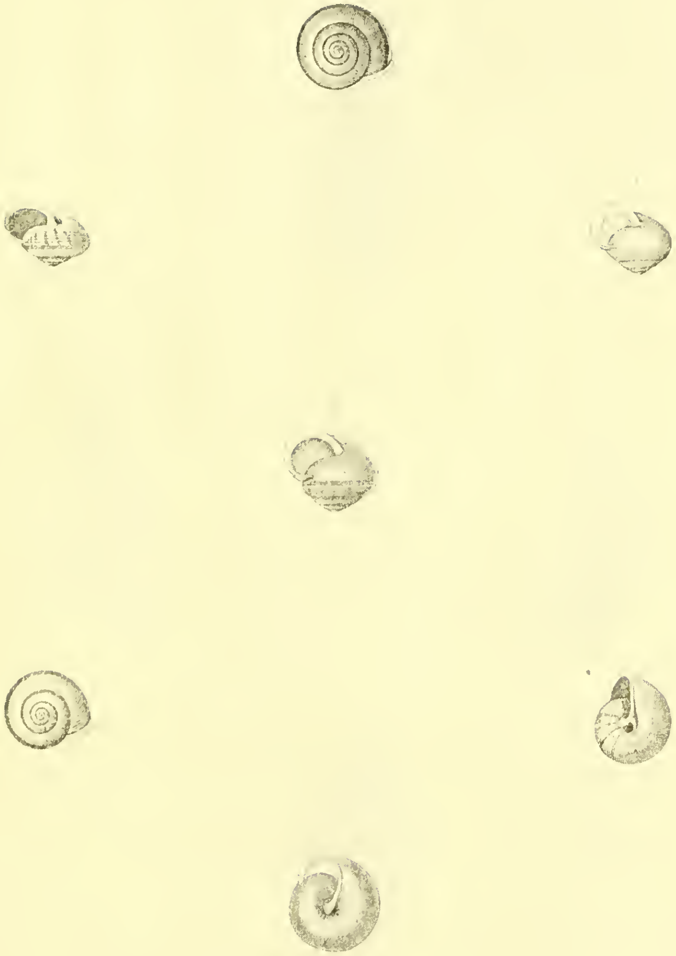
[illegible] [illegible]

[illegible]

1. Helix lineata Say. 2. Helix [illegible]

3. Helix multidentata Binney.

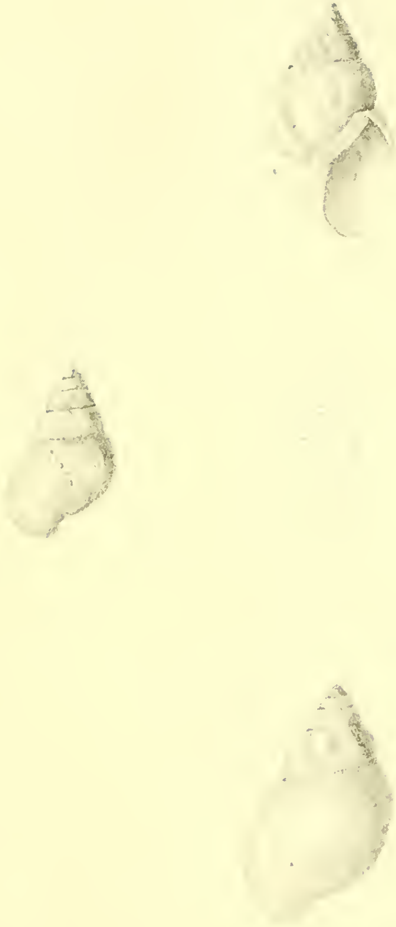
[illegible]



Helix Berlandieriana, Moricand. Helix albo zonata

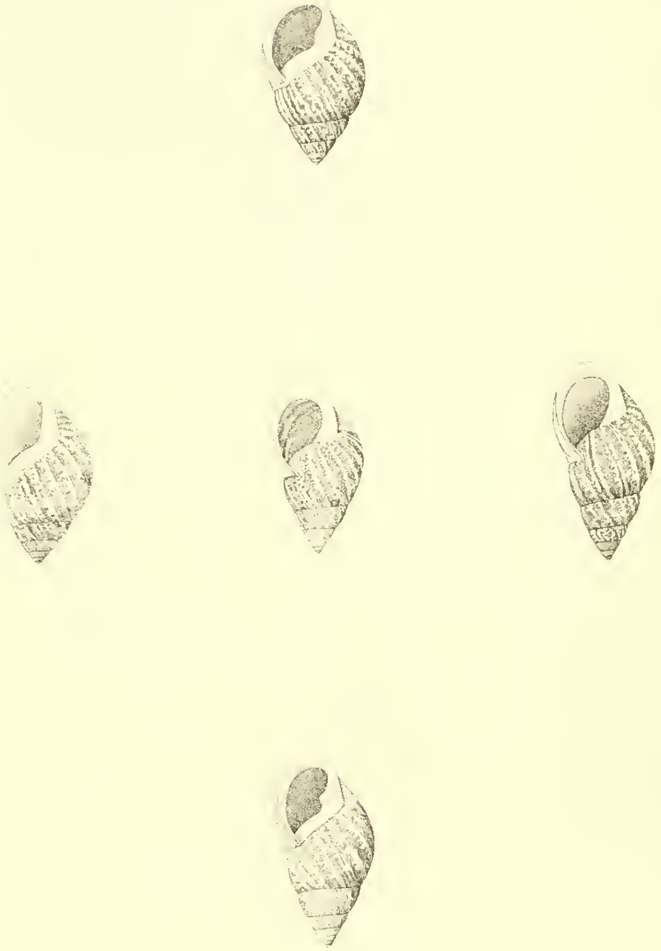
Mrs. Helen E. Lawson del

Alex Lawson

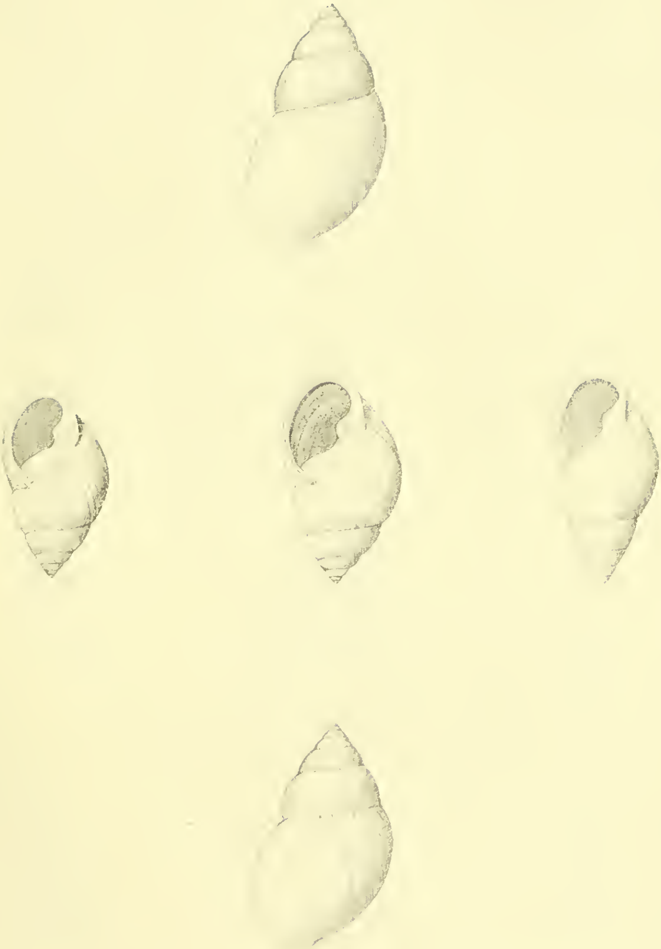


[illegible]

[illegible]



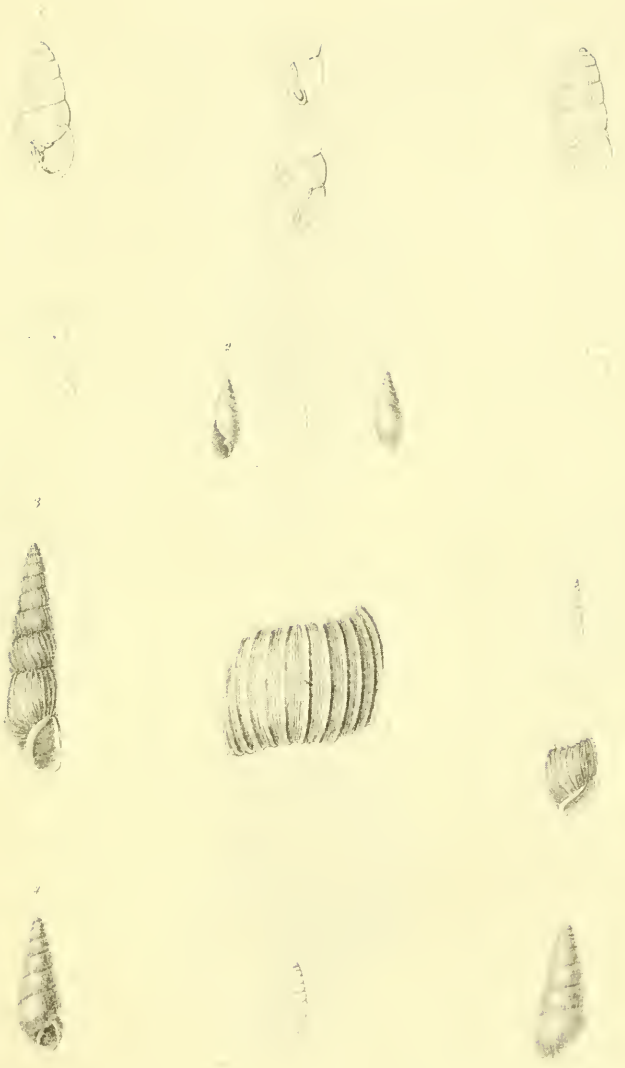
Bulimus dealbatus



Bulimus dealbatus

1. *Pupa [illegible]* Gould
2. *Bulimus [illegible]* Gould
3. *Pupa modica* Gould
4. *Bulimus lubricus*, Gould

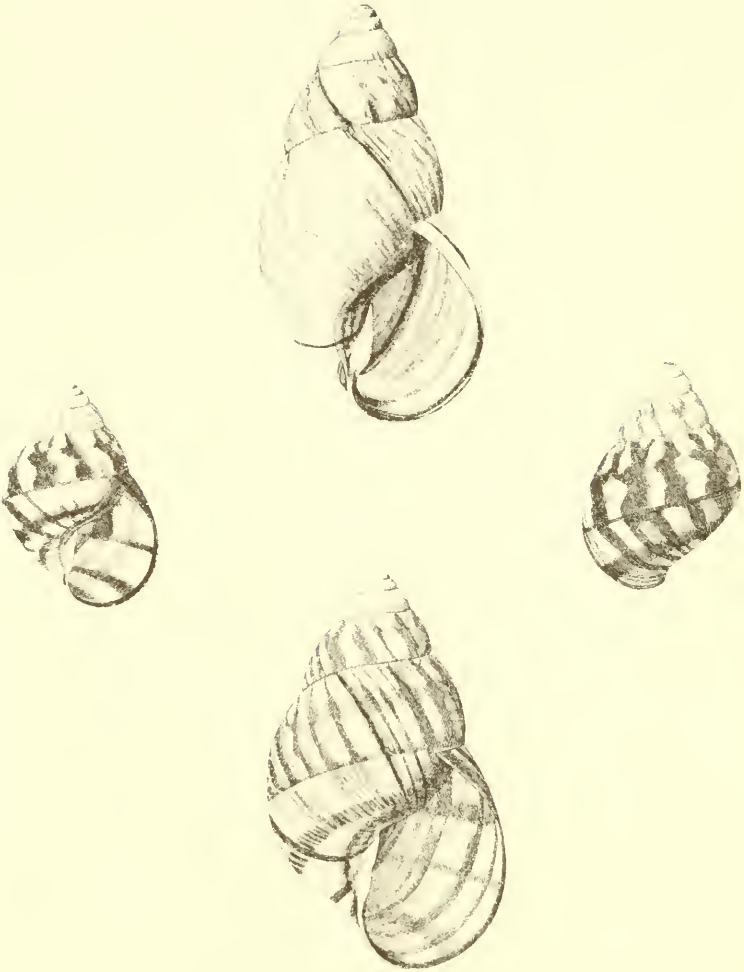
[illegible]



1 *Carychium exiguum* Say. 3 *Achatina gracillima* Pfeif.

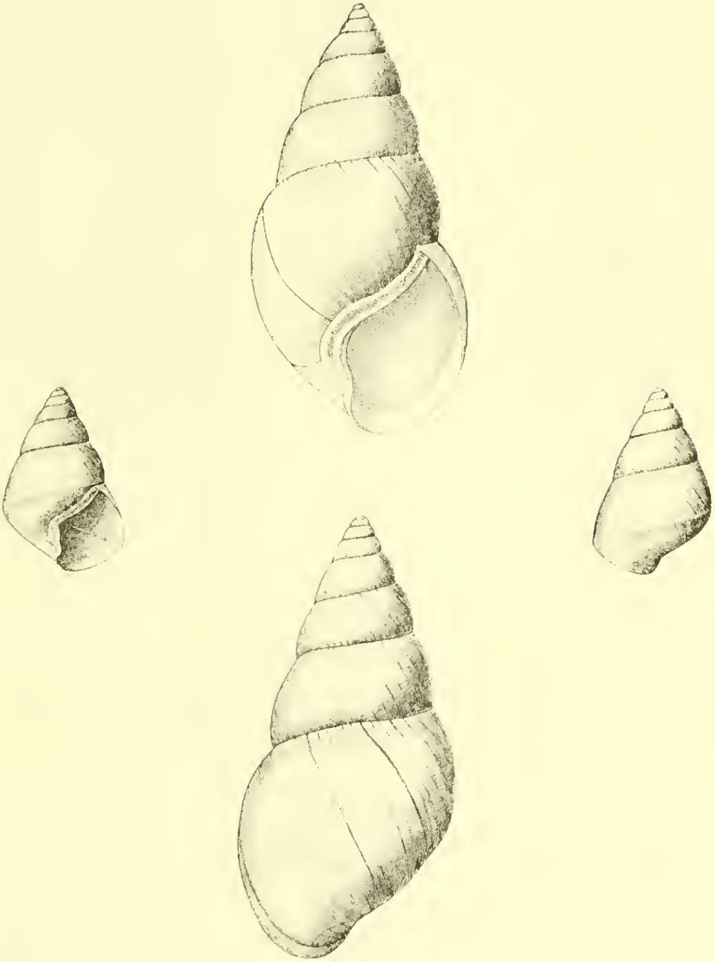
2 *Achatina pellucida*, Pfeif. 4 *Bulimus subula*, Pfeiffer.

Vve Tola a. delt



Bulimus zebra

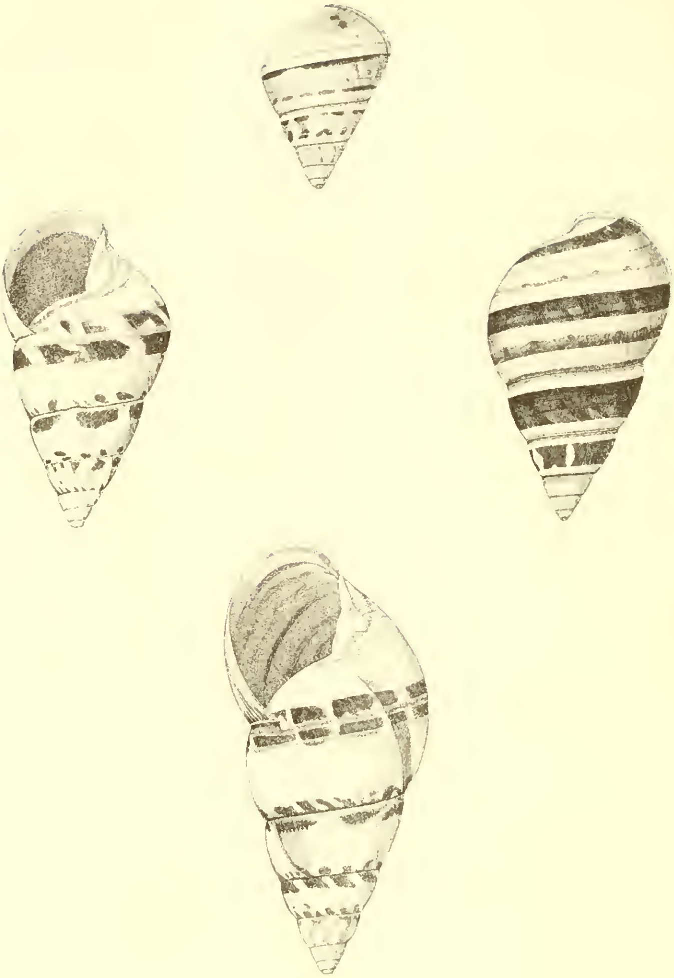
Pl. L



Bulimus fasciatus, M.

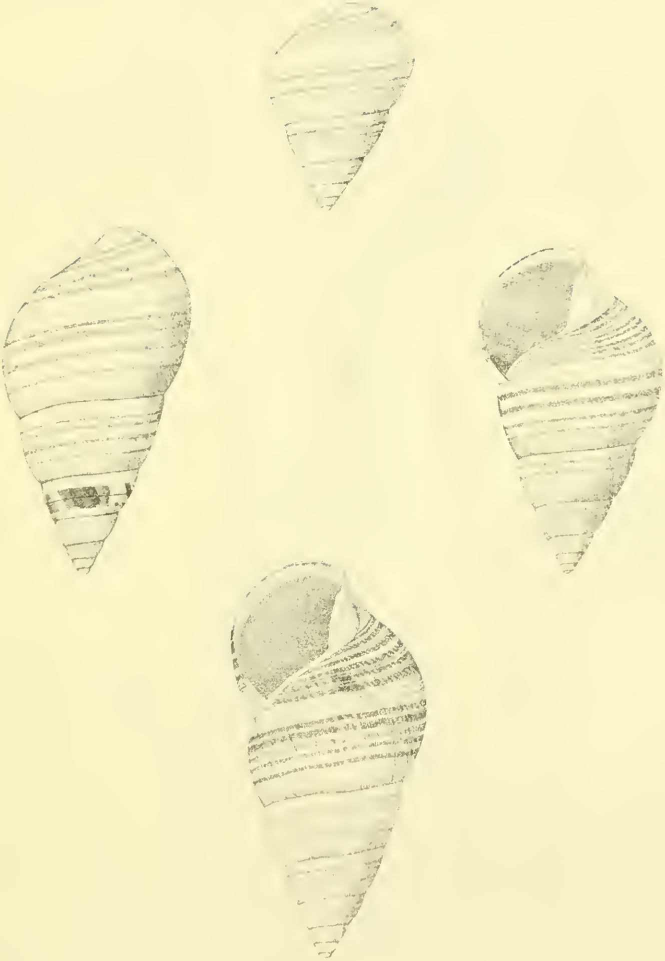
[illegible]

[illegible]



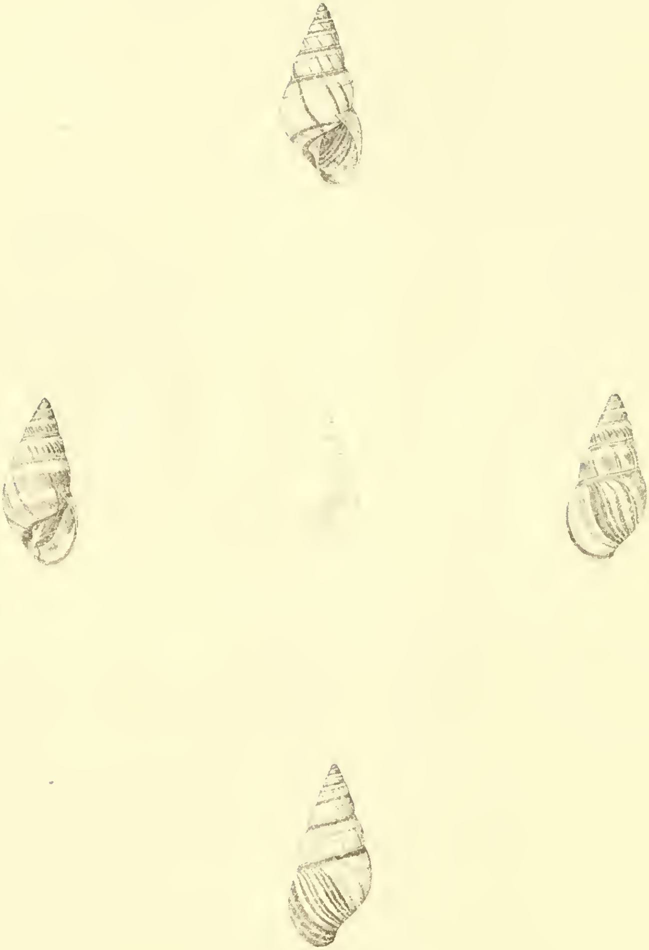
Bulimus fasciatus, Müll.

Miss E. Bowater del. [illegible]

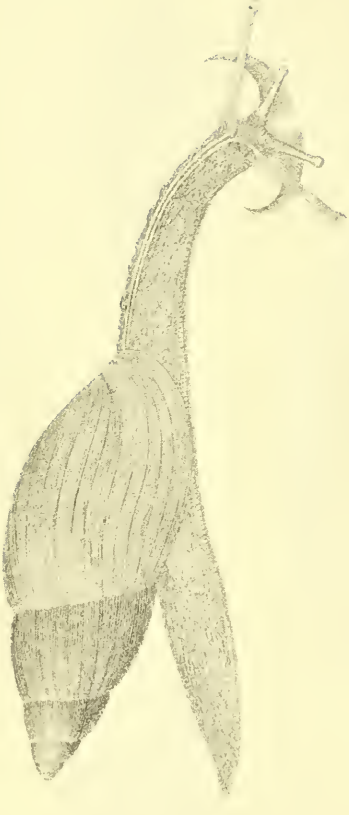


Bulimus fasciatus,

Alex. Newsen



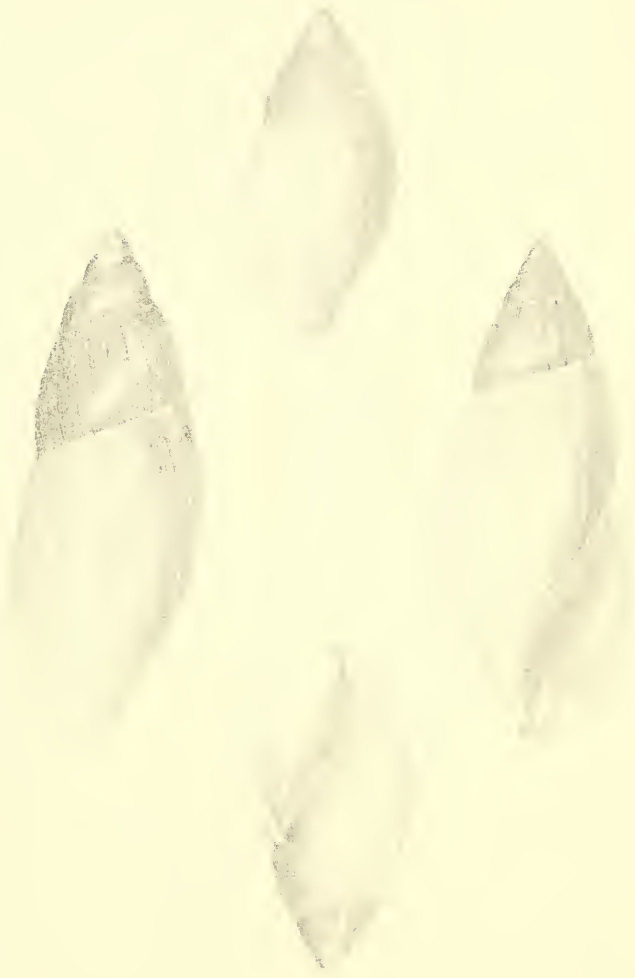
Bulimus [illegible]



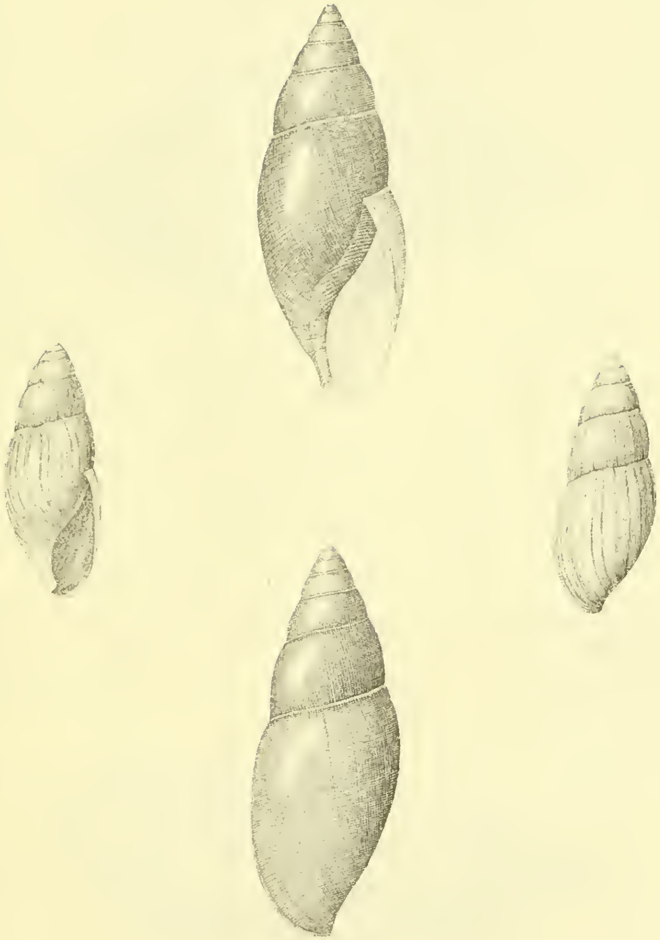
Glandina truncata Say

Nutting del.

[illegible]

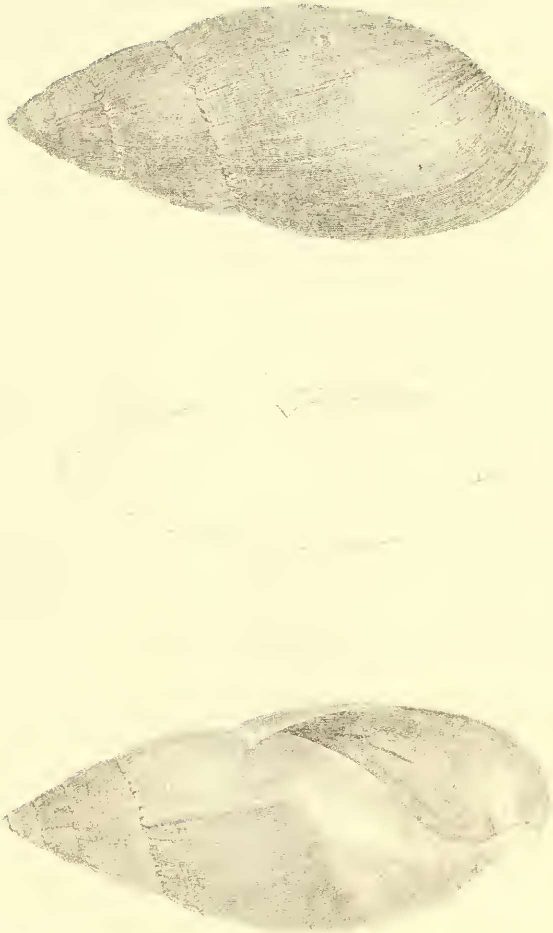


Glandina truncata



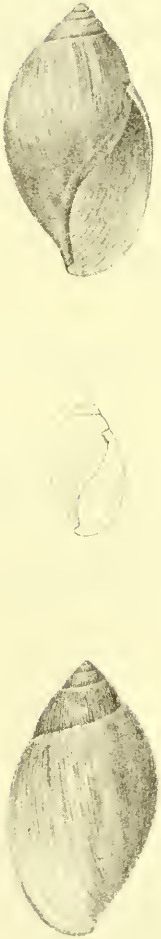
Glandina truncata

Alex. Lawson



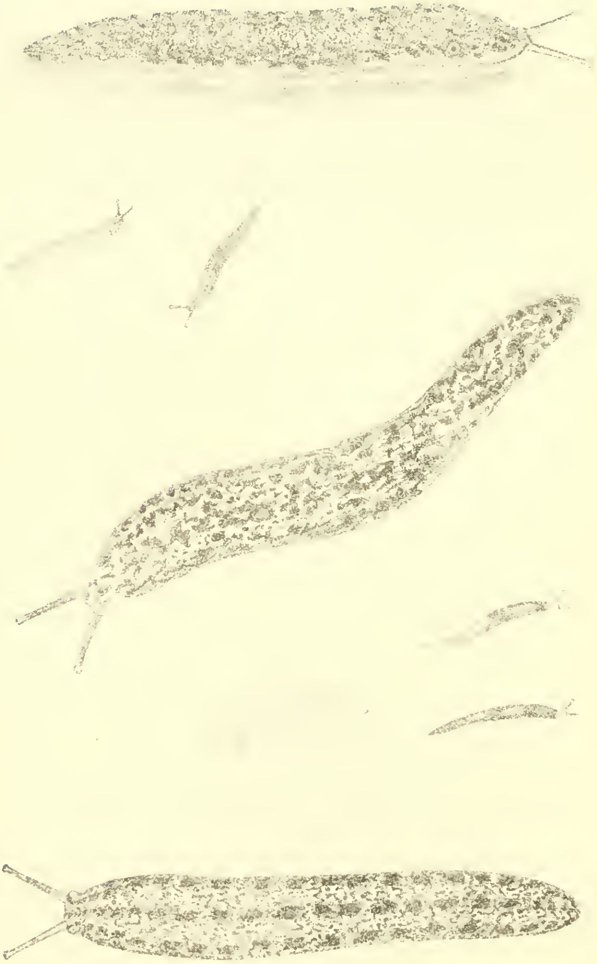
Glandina Vanuxemensis

[illegible]



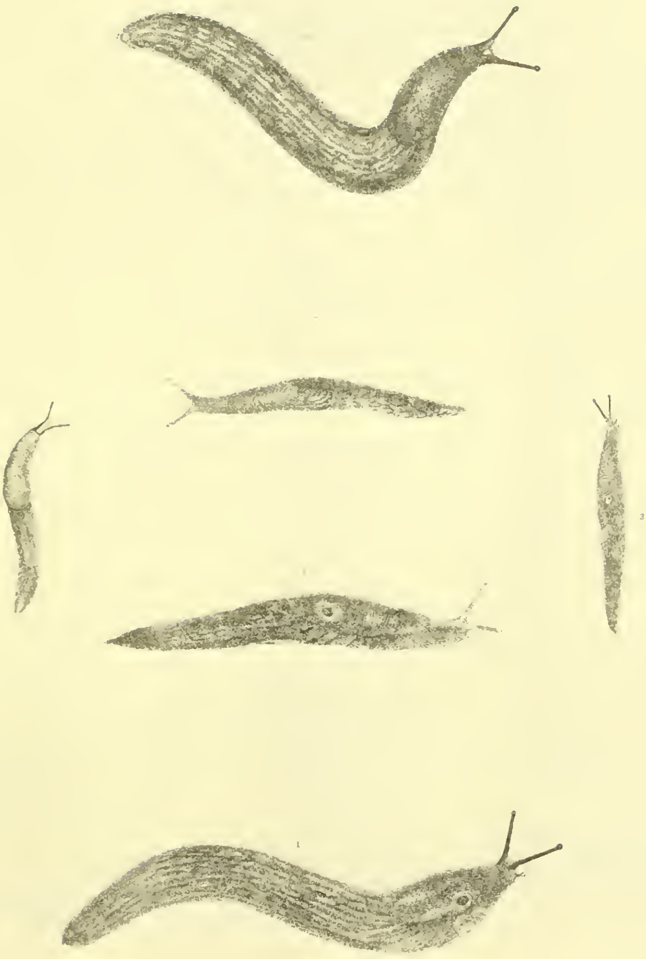
Glandina bullata Gould

Vve Delarue delt



[illegible]

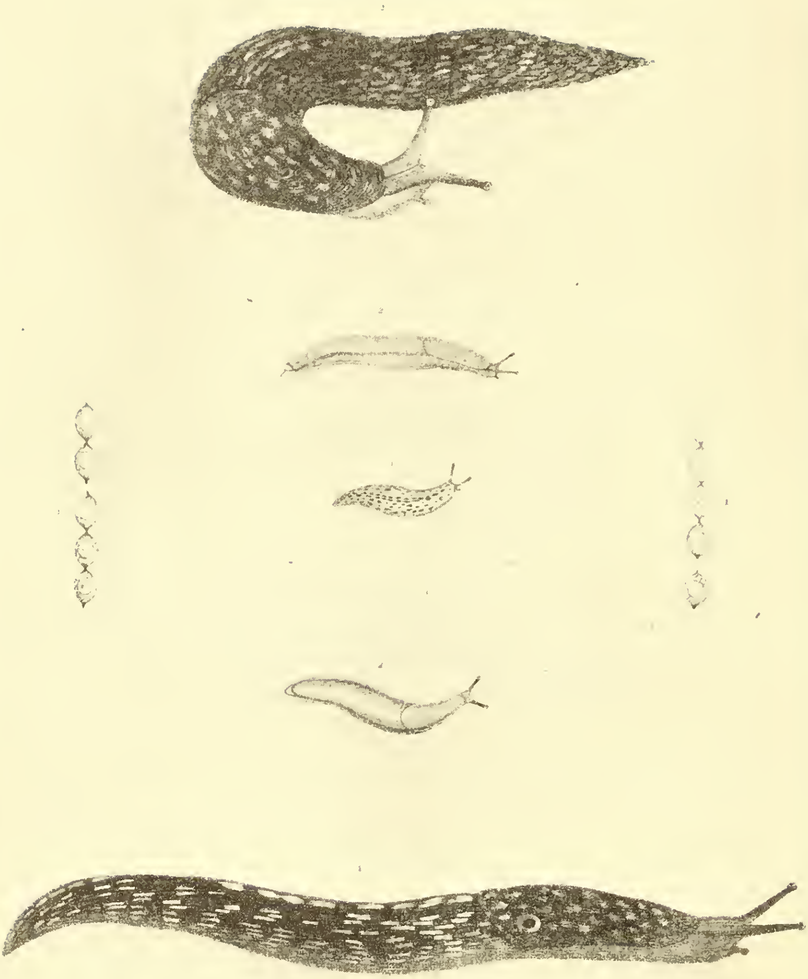
[illegible]



1 *Arion hortensis.* Fer 2 *Limax agrestis.* Müll.
3 *Limax campestris*

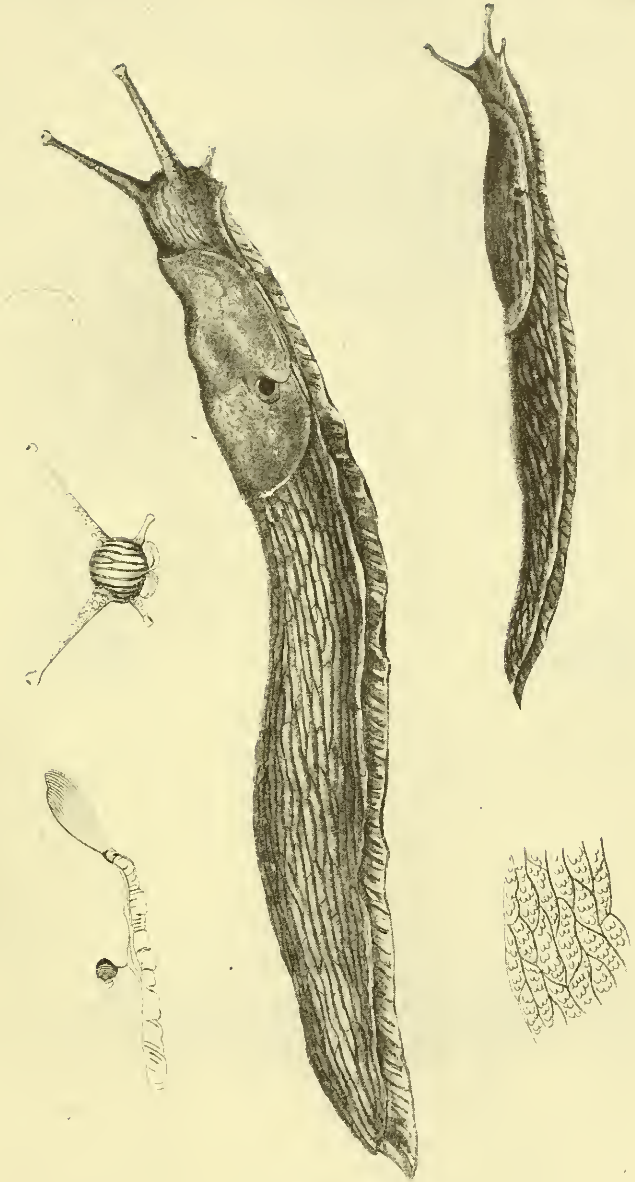
[illegible] W H Tuppen

PL. LXV.



Limax variegatus, Drap *Arion hortensis*, Fer

Miss H E Lawson del W H Tappan sc

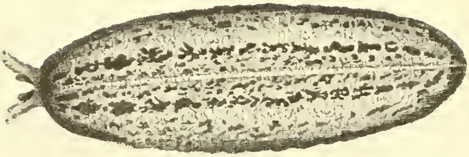


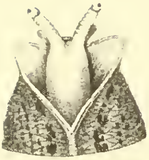
Limax Columbianus. Gould

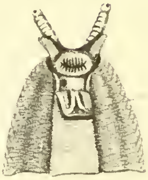
Arion foliolatus. Gould

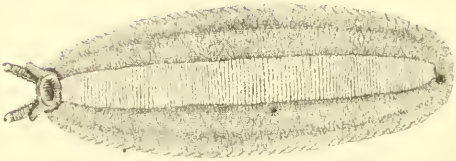
Drayton del.

Sutton







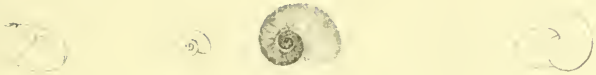


Vaginulus floridanus

J. Leidy del

Alex Lawson

1



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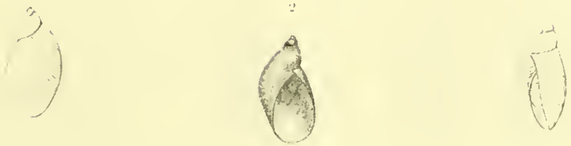

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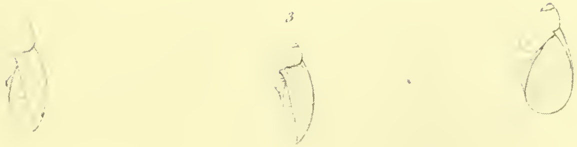

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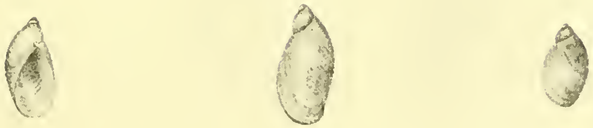
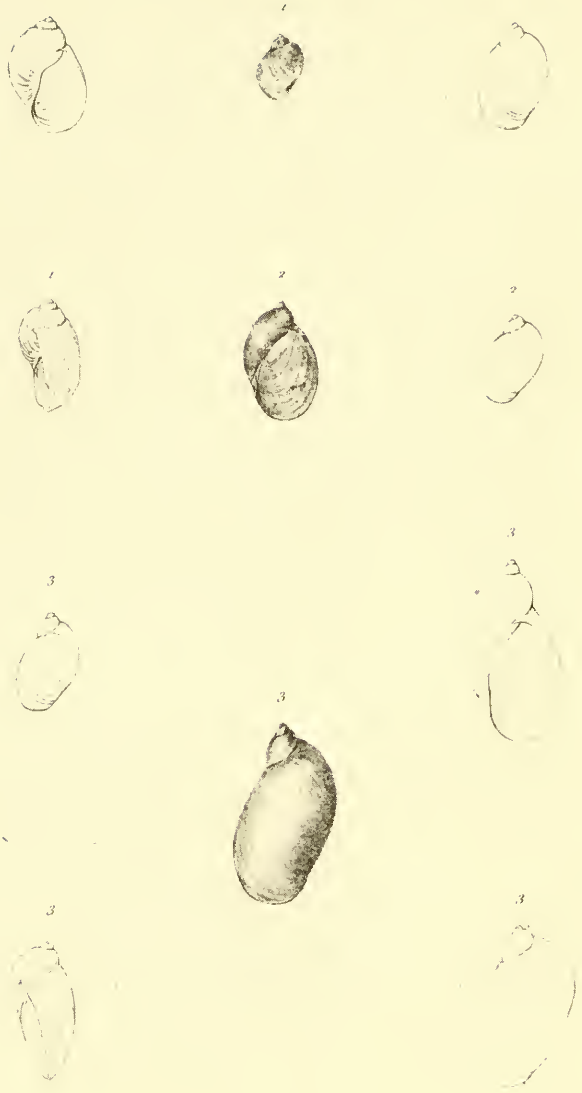


1. *Vitrina pellucida.* 2. *Succinea concordialis.*

3. *Succinea ovalis.* 4. *Succinea nuttaliana.*

Vve Delarue rue Montagne Ste Geneviève 11

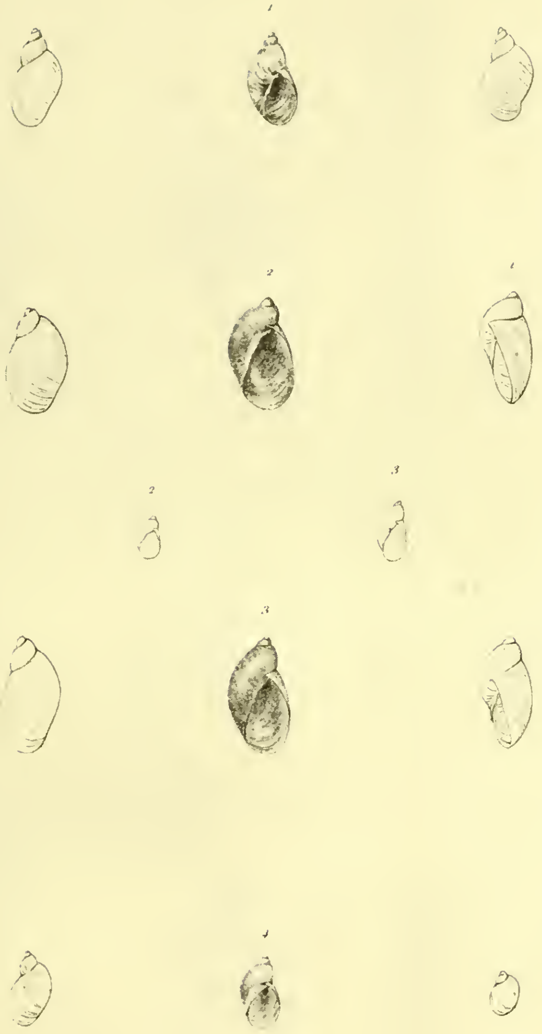
Pl. [illegible] b



Wallis del.

1 *Succinea campestris, Say.* 2 *Succinea Totteniana, Lea.*

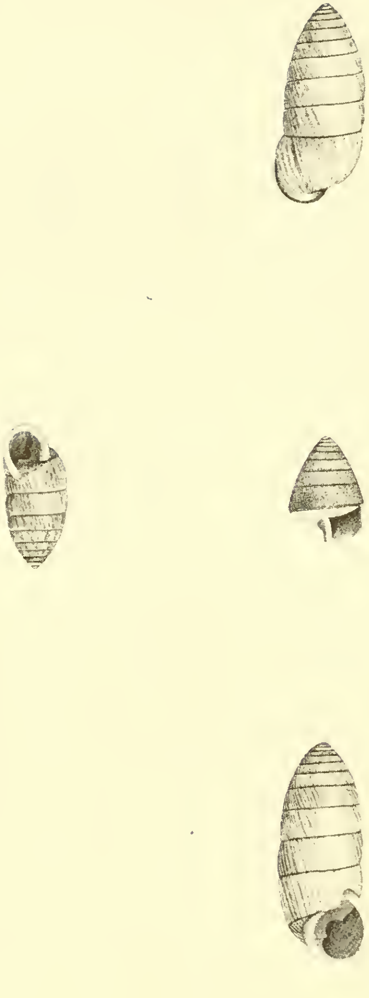
3 *Succinea obliqua, Say.*



Wallis del.

1 *Succinea luteola* Gould. 3 *Succinea oregonensis*, Lea.
2 *Succinea aurea*, Lea 4. *Succinea avara*, Say.

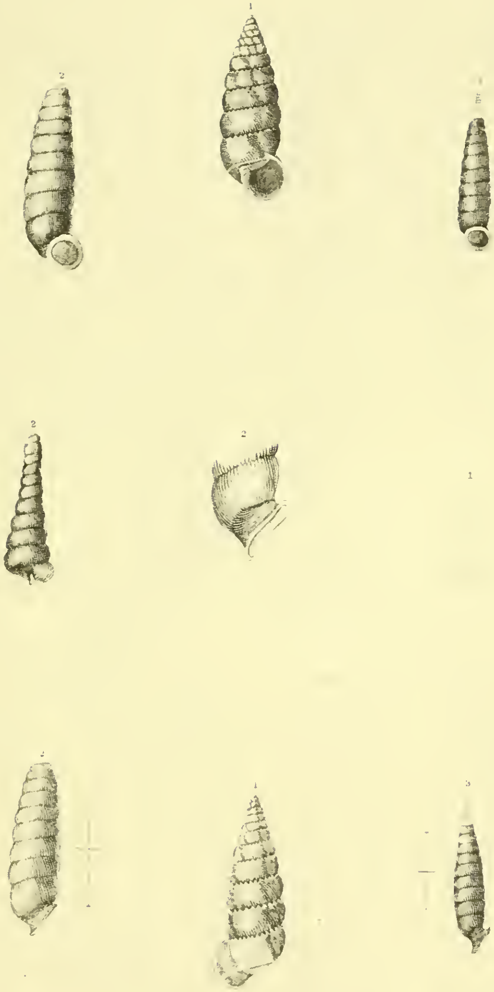
Vve Delarue direct. Montagne Ste Genevieve 6.



Pupa incana

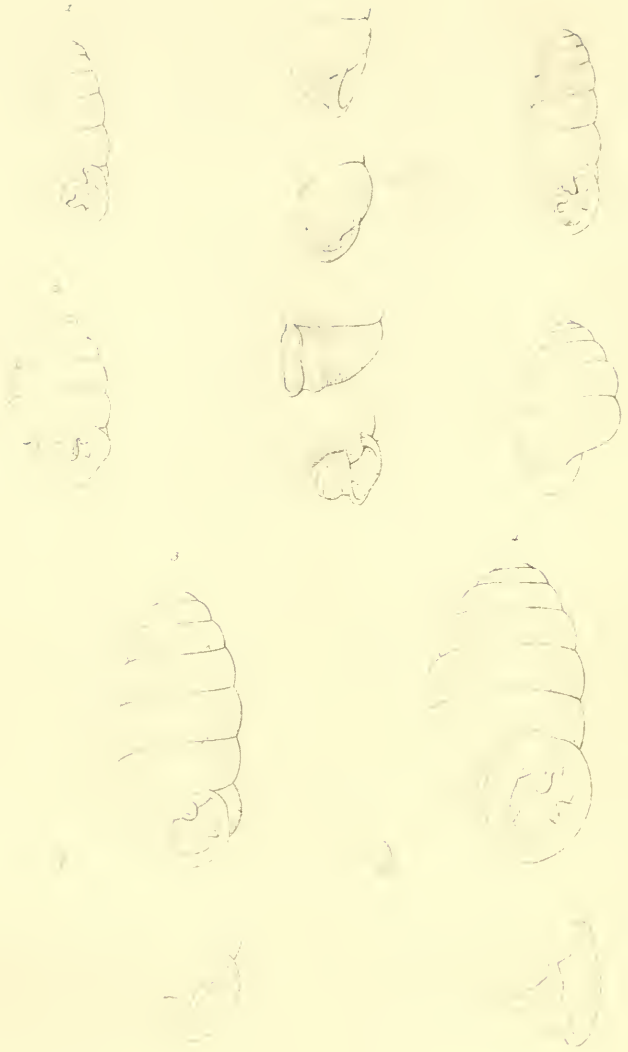
Miss H.E. Lawson del.

Alex Lawson



1 *Cylindrella pontifica*, Gould 2 *C. lactaria.* Gould
3 *C. jejuna.* Gould.

Miss S. E. Lawson del. [illegible]



1. Pupa rupicola, Say. 2. Pupa badia, Adams.
3. Pupa contracta, Say. 4. Pupa armigera, Say.

[illegible]

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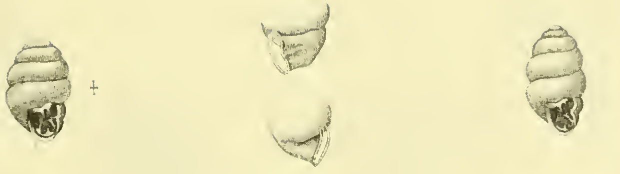

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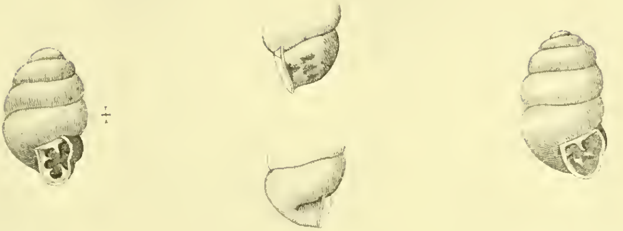

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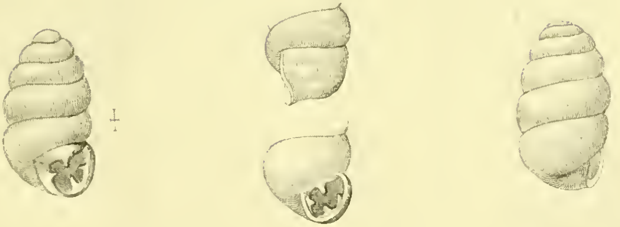

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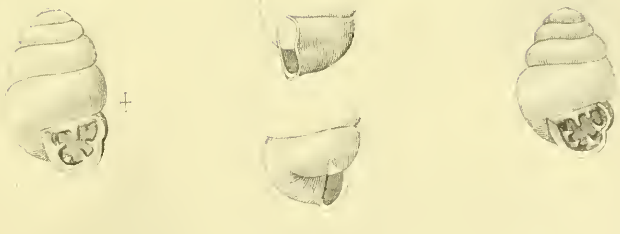
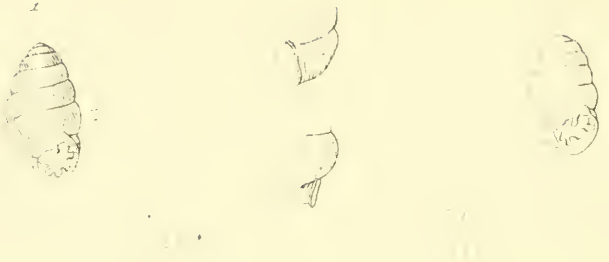


1 *Vertigo milium. Gould*
2 — *Gouldii. Binney*

3 *Pupa decora. Gould.*
4 *Vertigo modesta. Say.*

Pl. LXVI.

1



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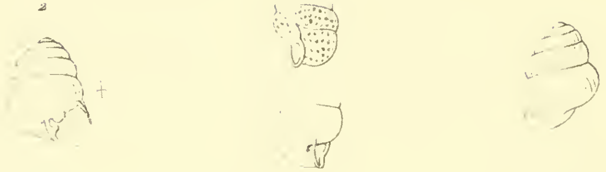

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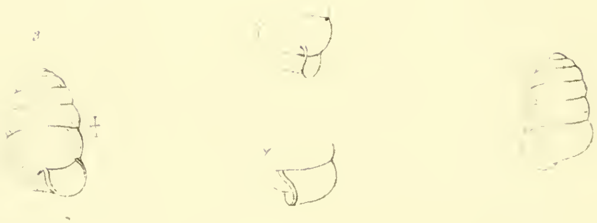

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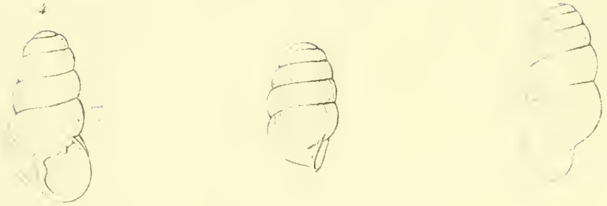
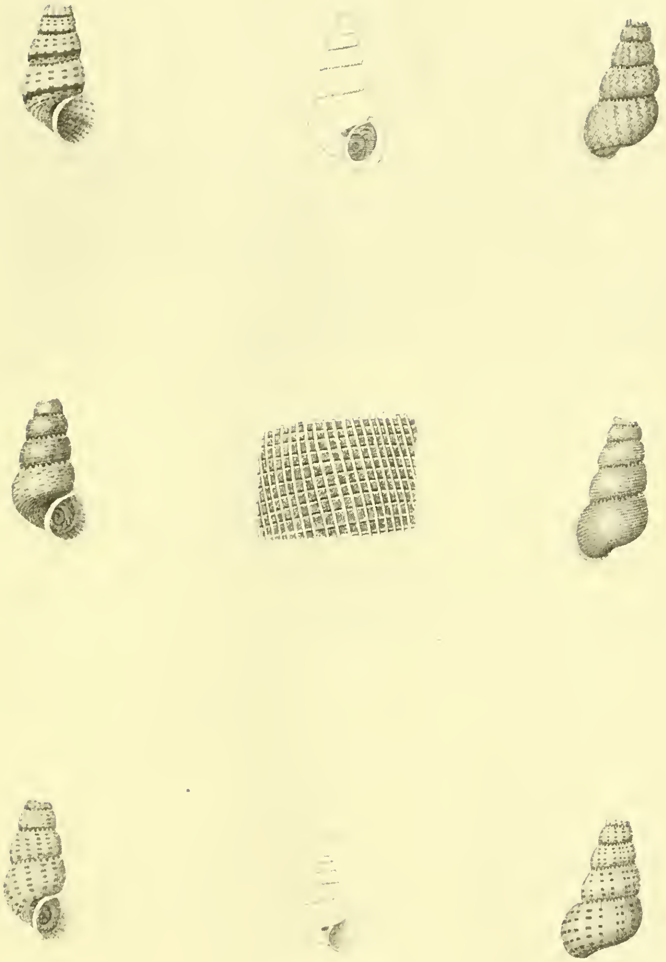


1 *Pupa pentodon*, *Say*. 2 *Pupa variolosa*, *Gould*.

3 *Pupa simplex*, *Gould*. 4 *Pupa corticaria*, *Say*.

Vve B. [illegible] del.

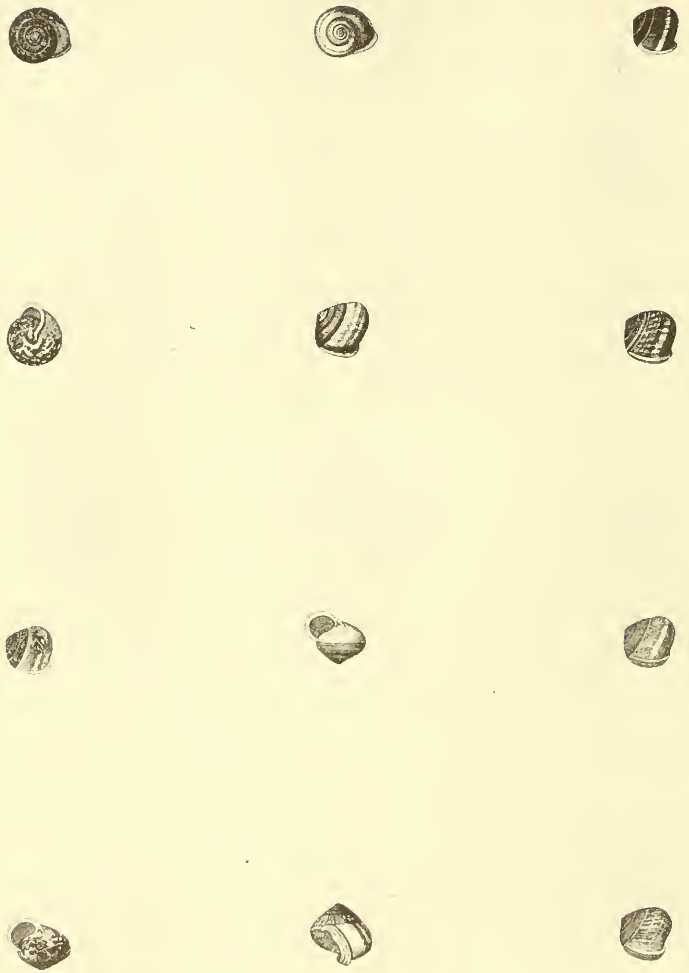
Pl. LXX [illegible] a



Cyclostoma dentatum, Sav.

[illegible] on del.

Alex Lawson Sc.



Helicina orbiculata;— Say

Miss Helen E Lawson del.

Alex Lawson Sc

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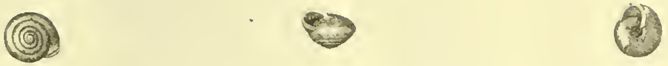

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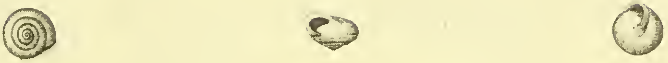

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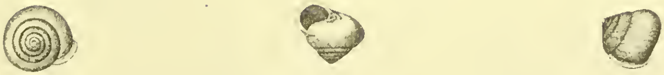

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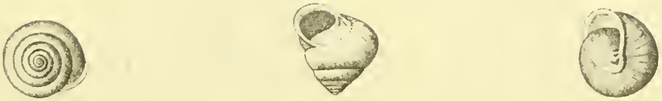
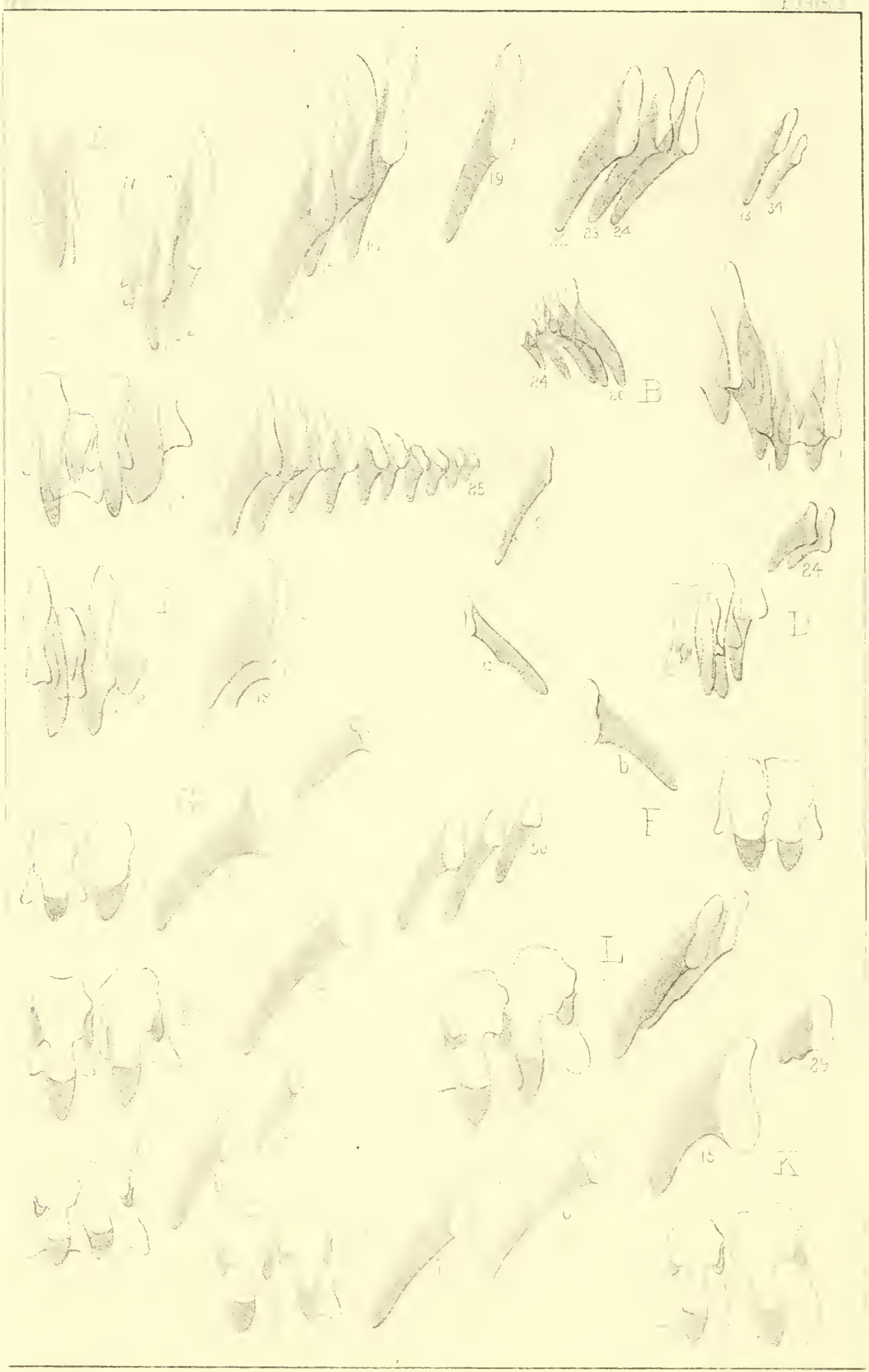


1 *Helecina rubella, Green* 3 *Helecina orbiculata,* — *Say*
2 —— *occulta,* — *Say* 4 —— *chrysocheila*

Miss Helen E. Lawson del *Alex Lawson Sc*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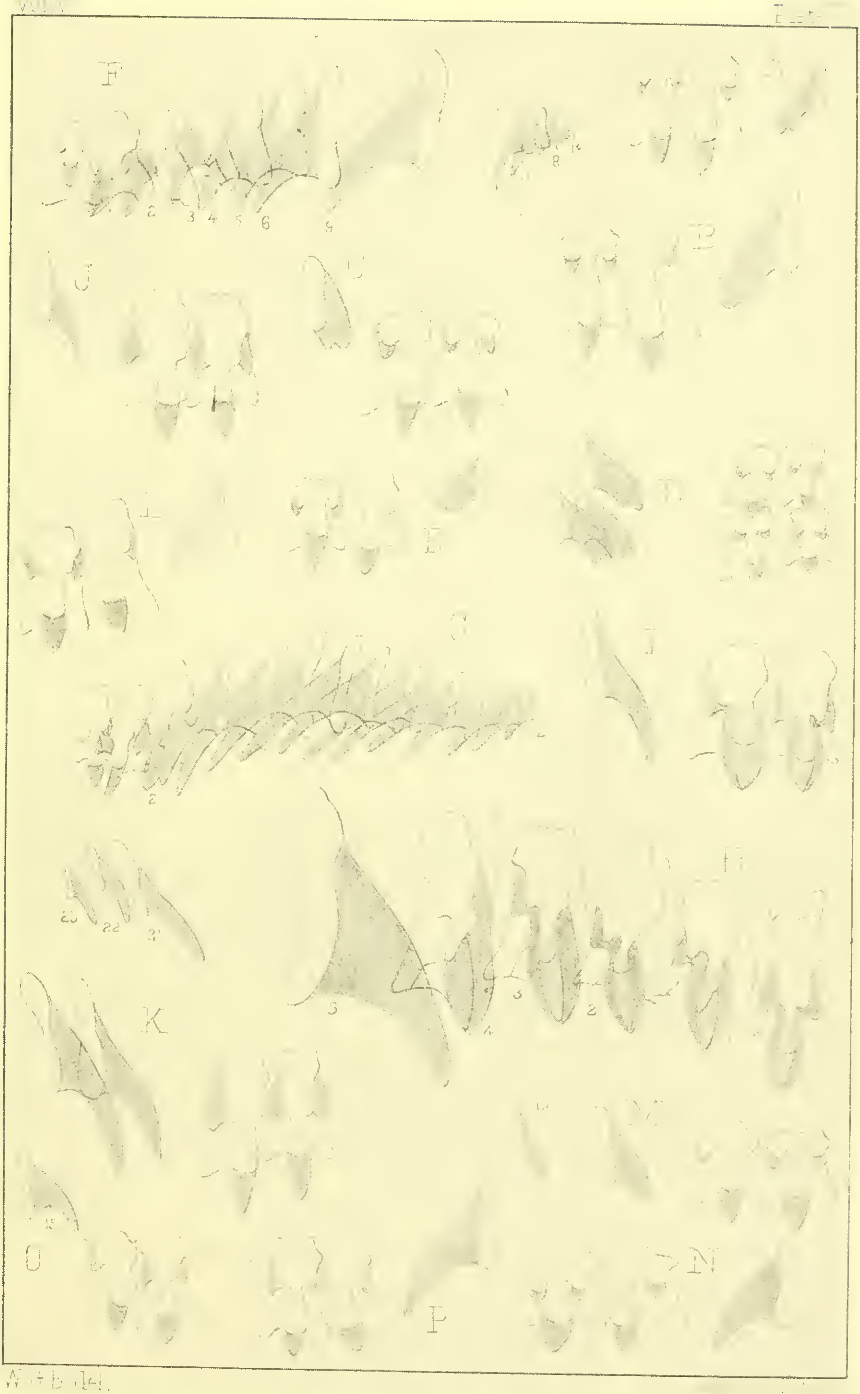
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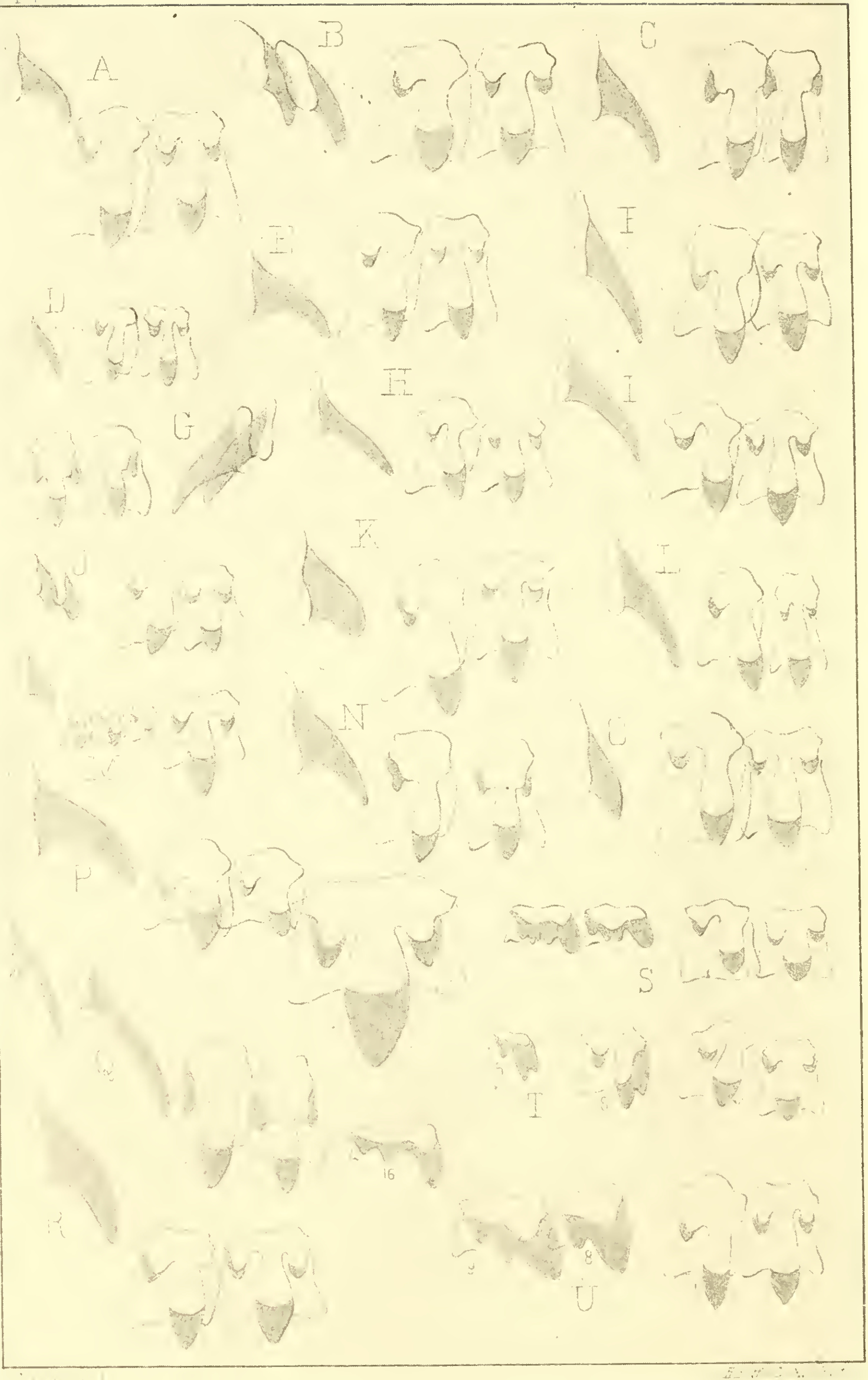
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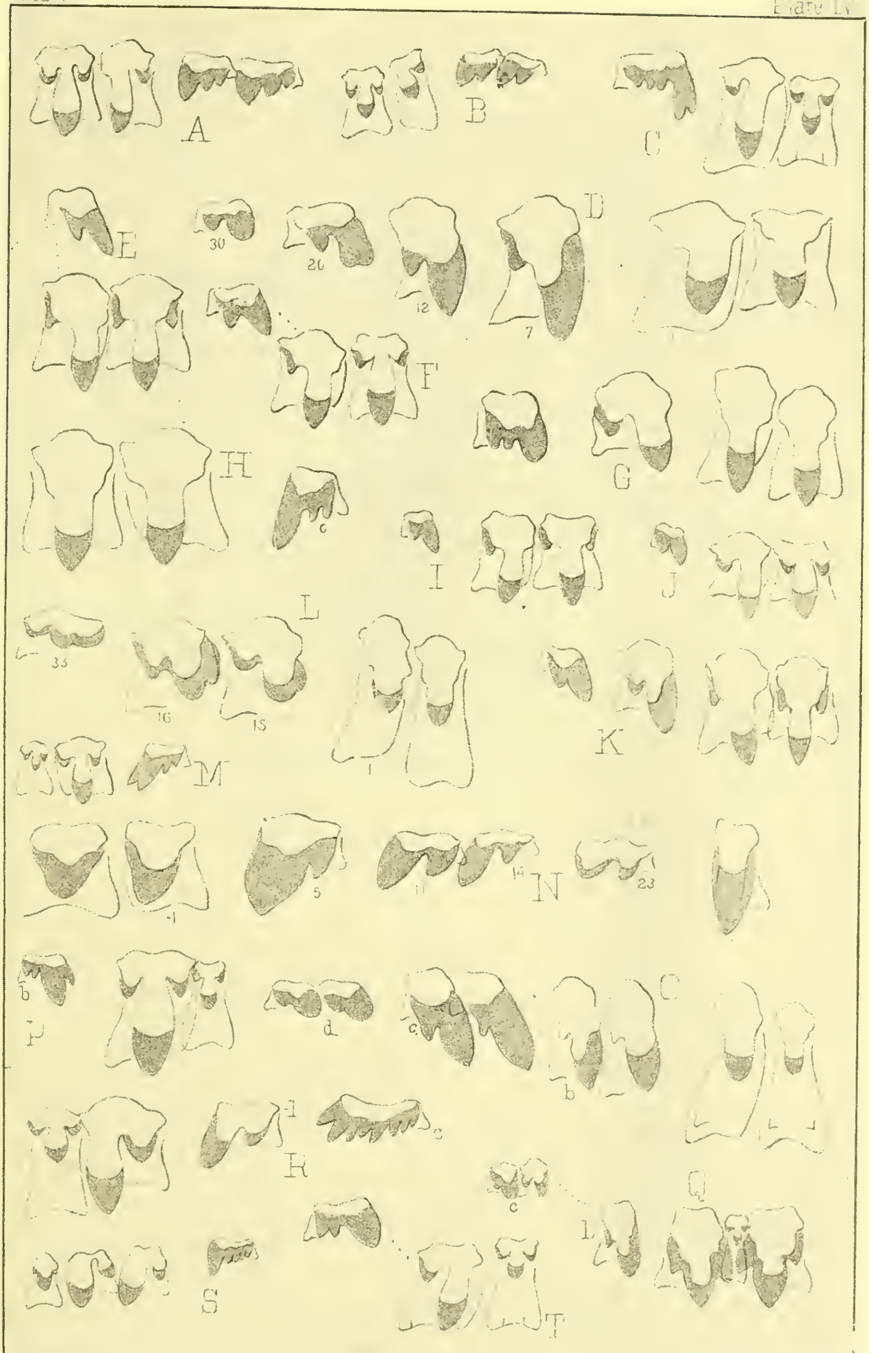
[illegible] del.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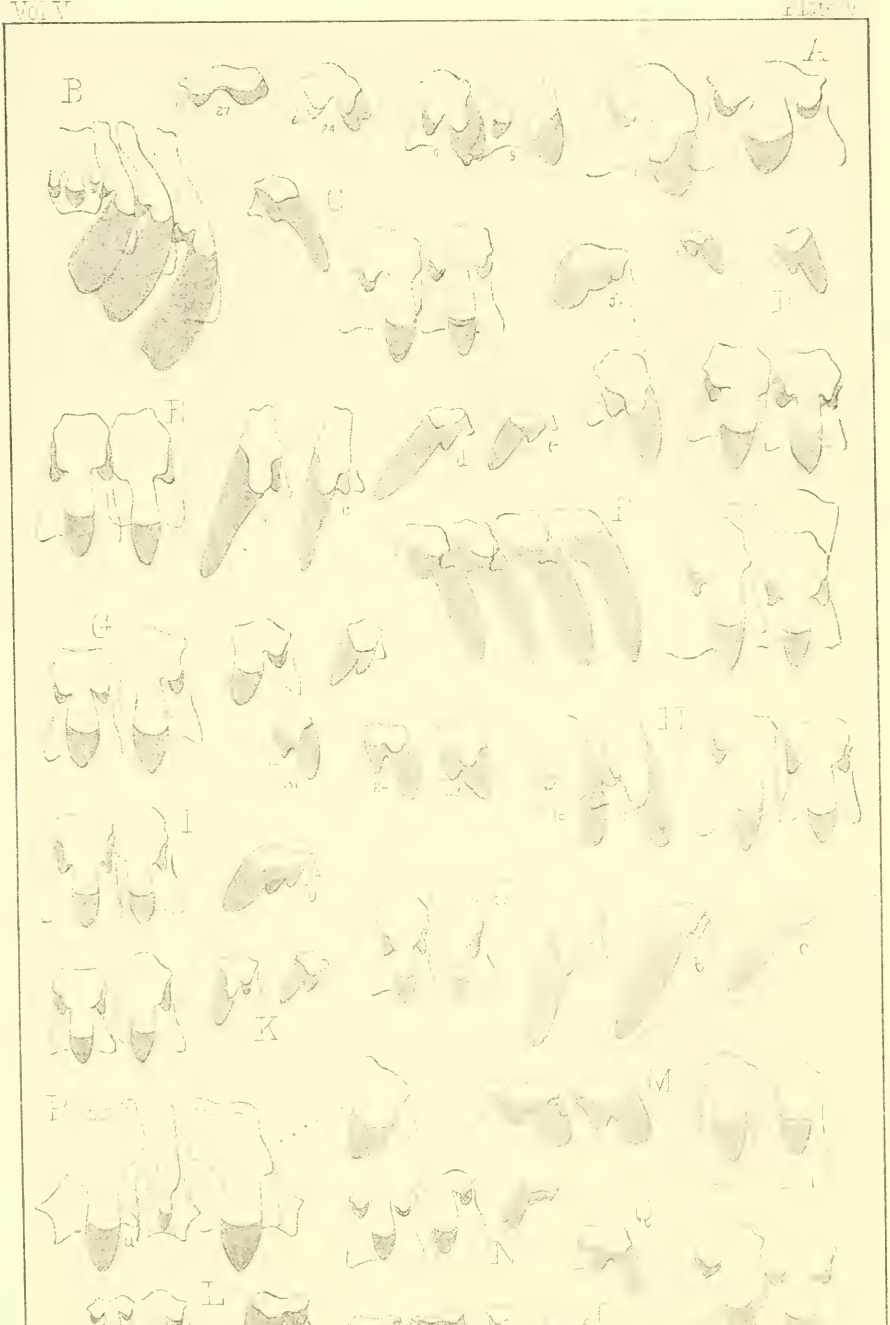
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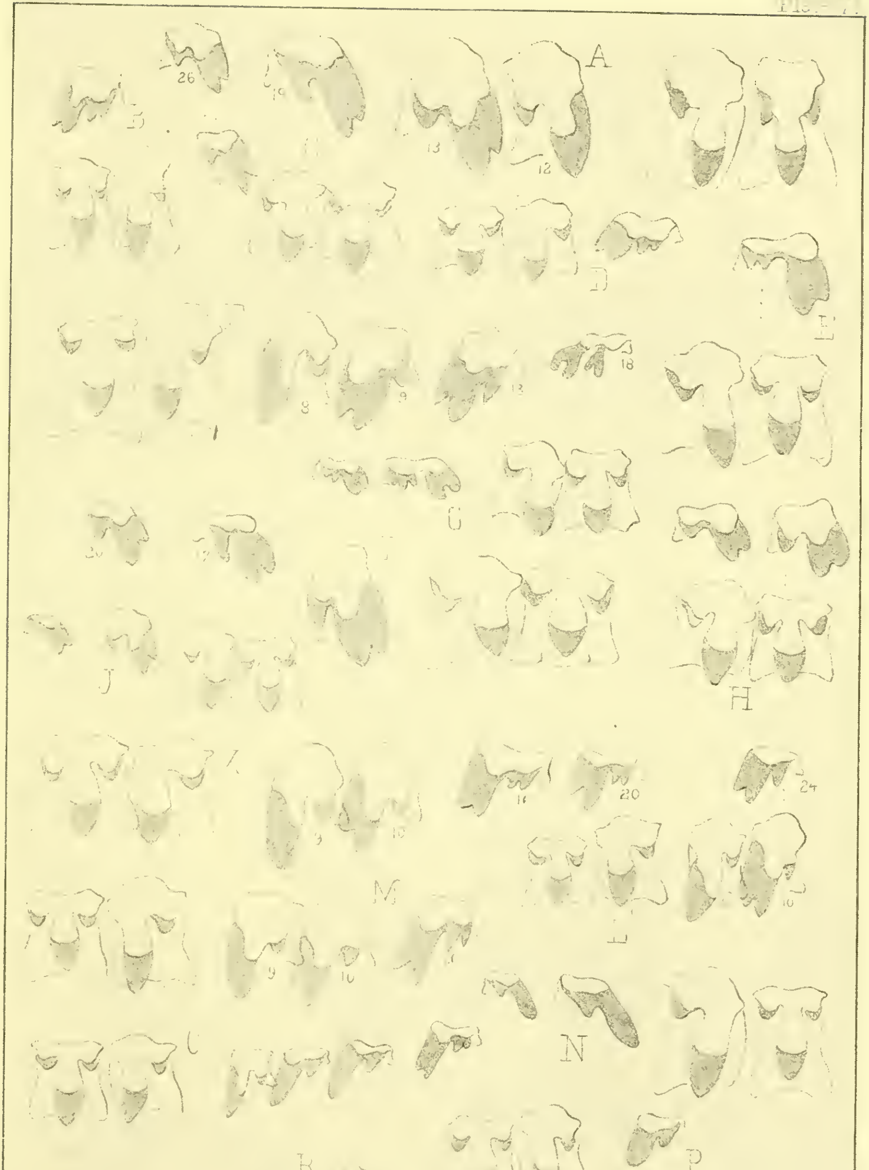
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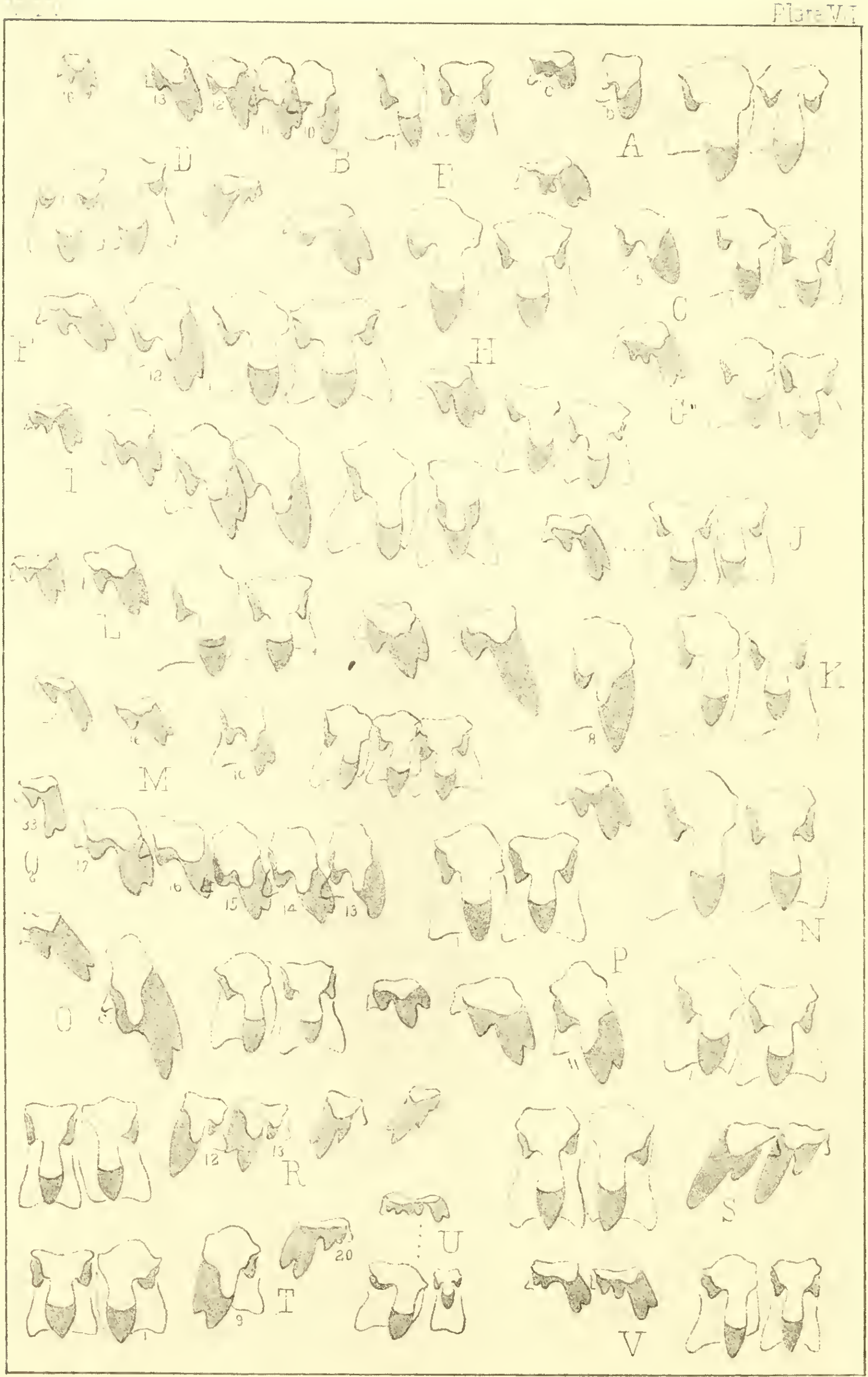
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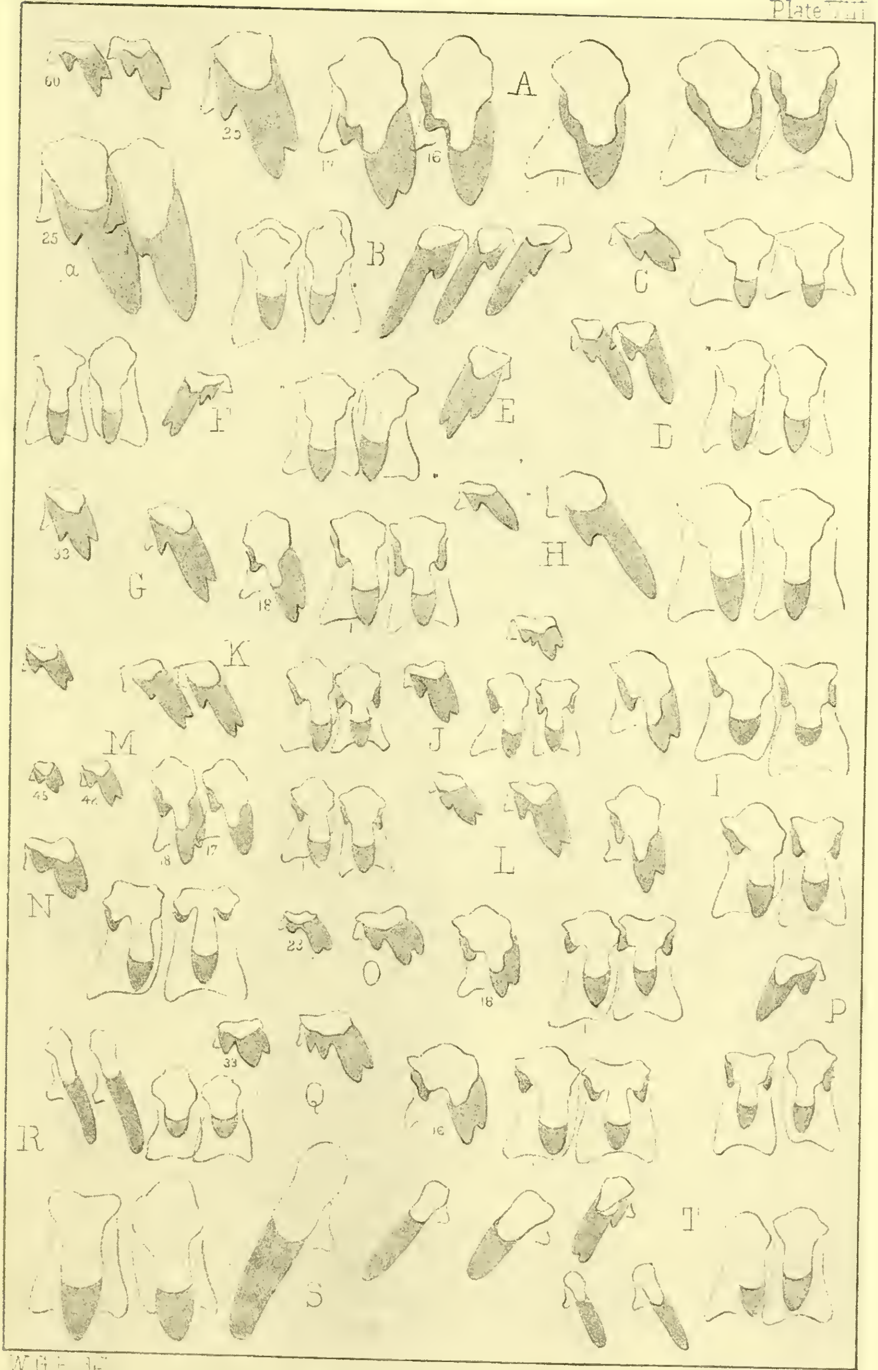
W. G. E. del.

H. Bolton [illegible]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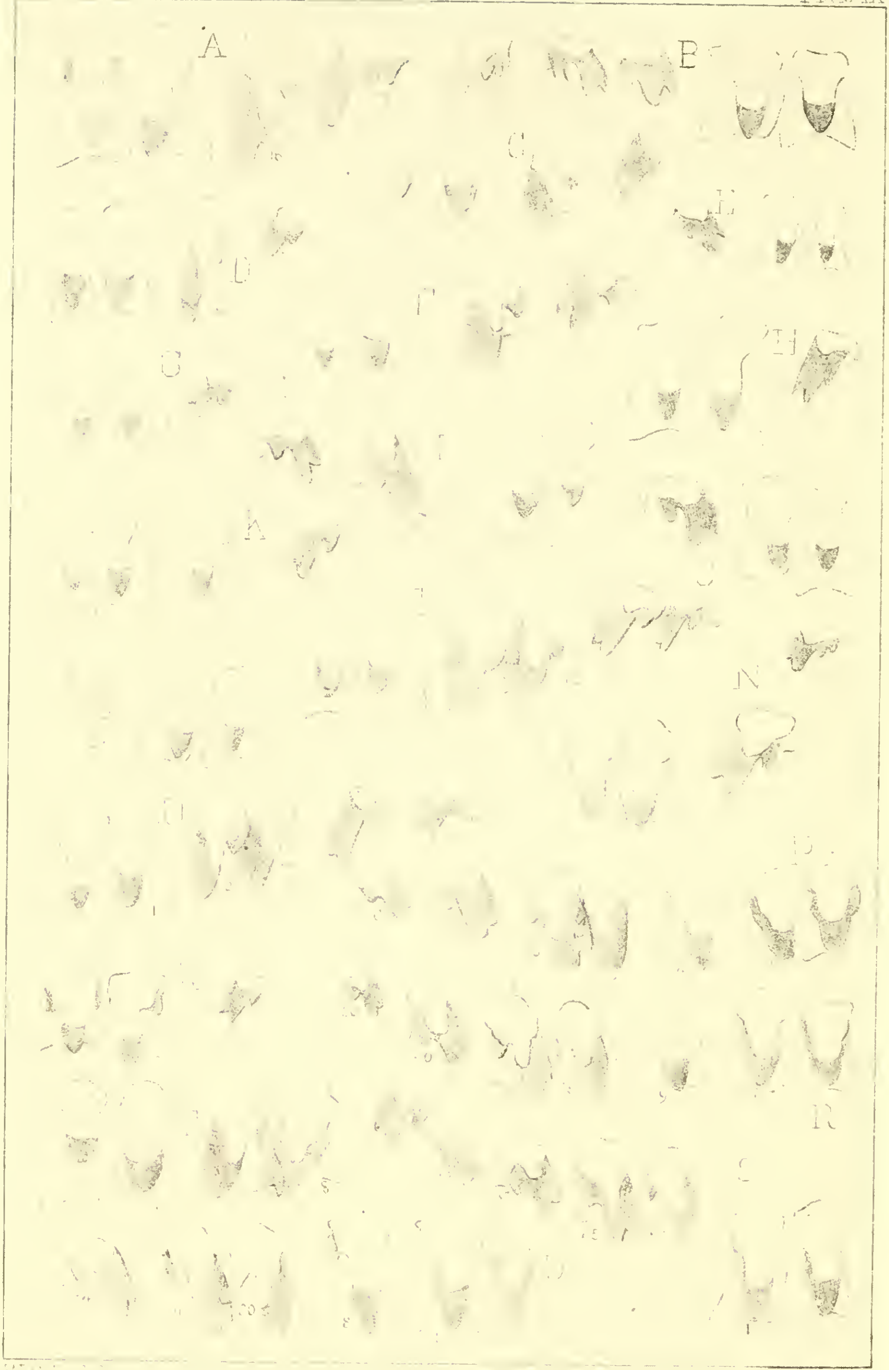
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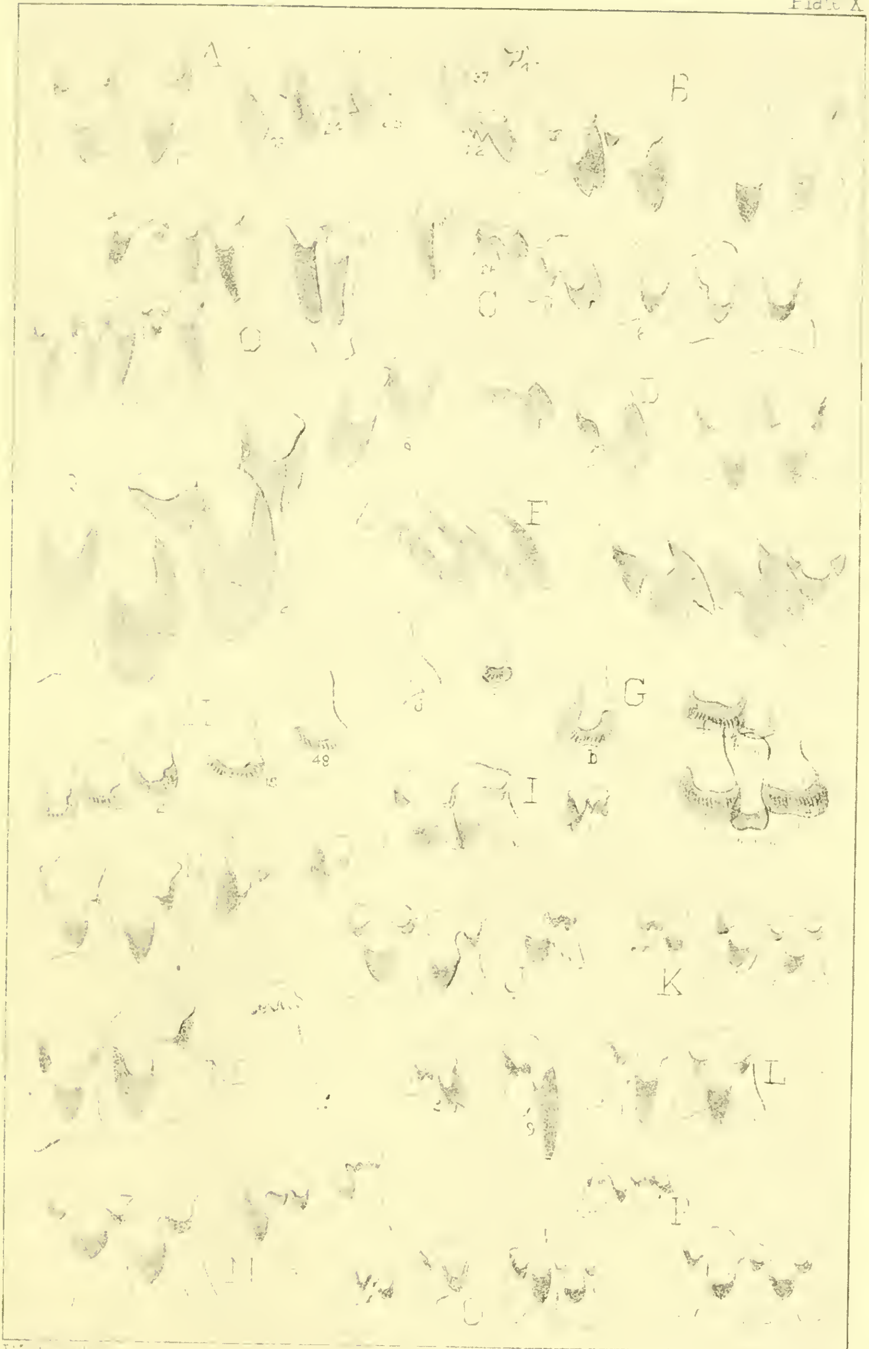
Vol V

Plate X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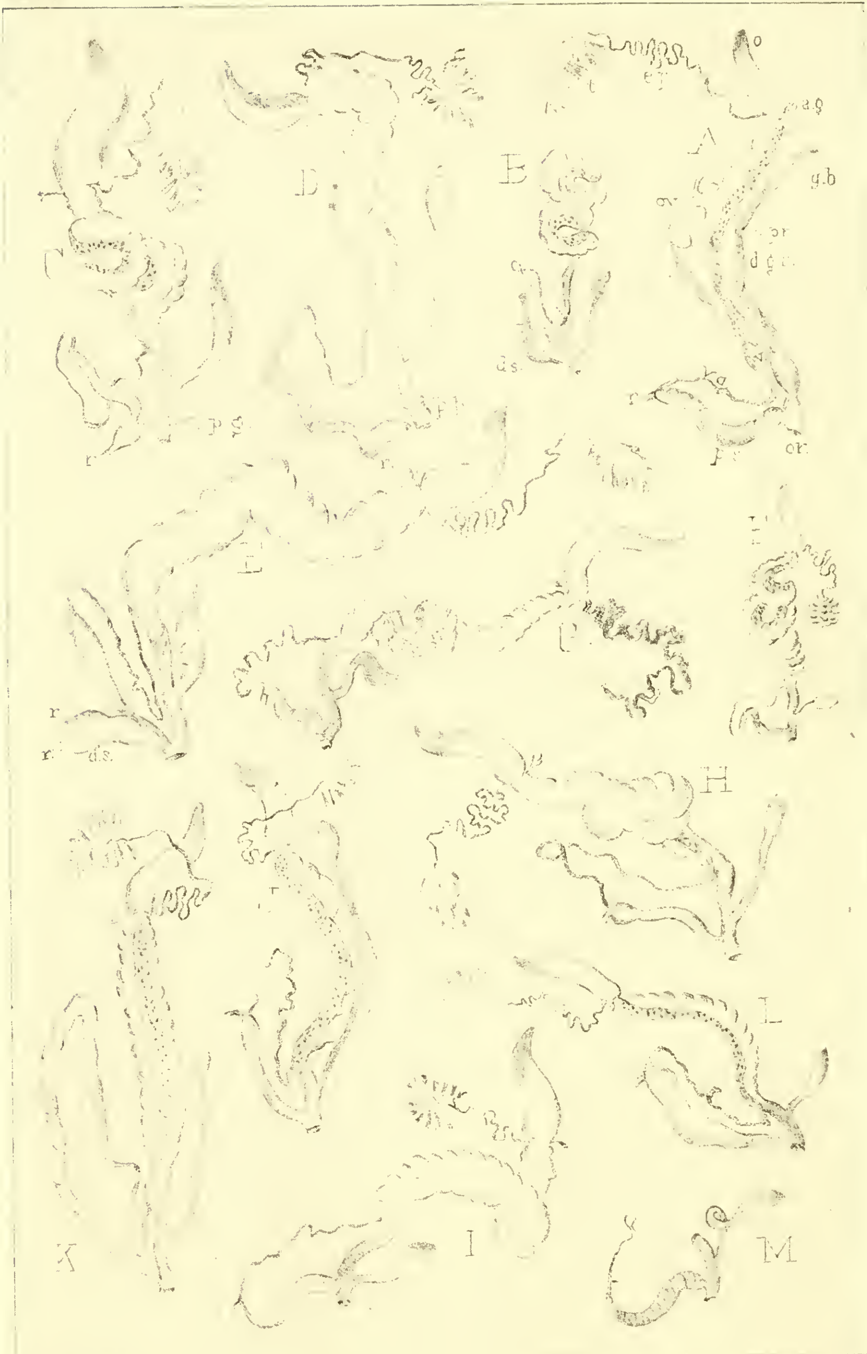
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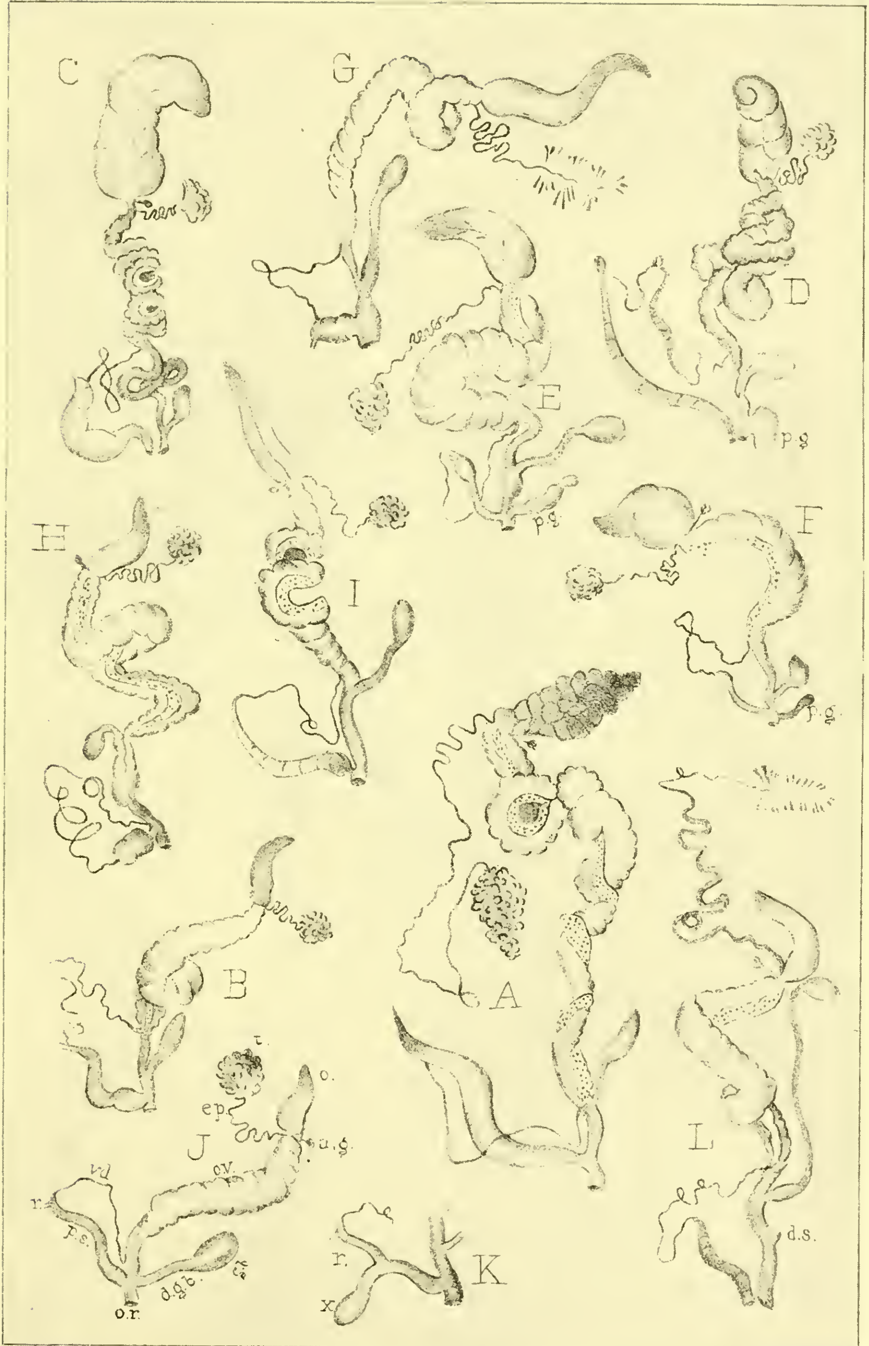
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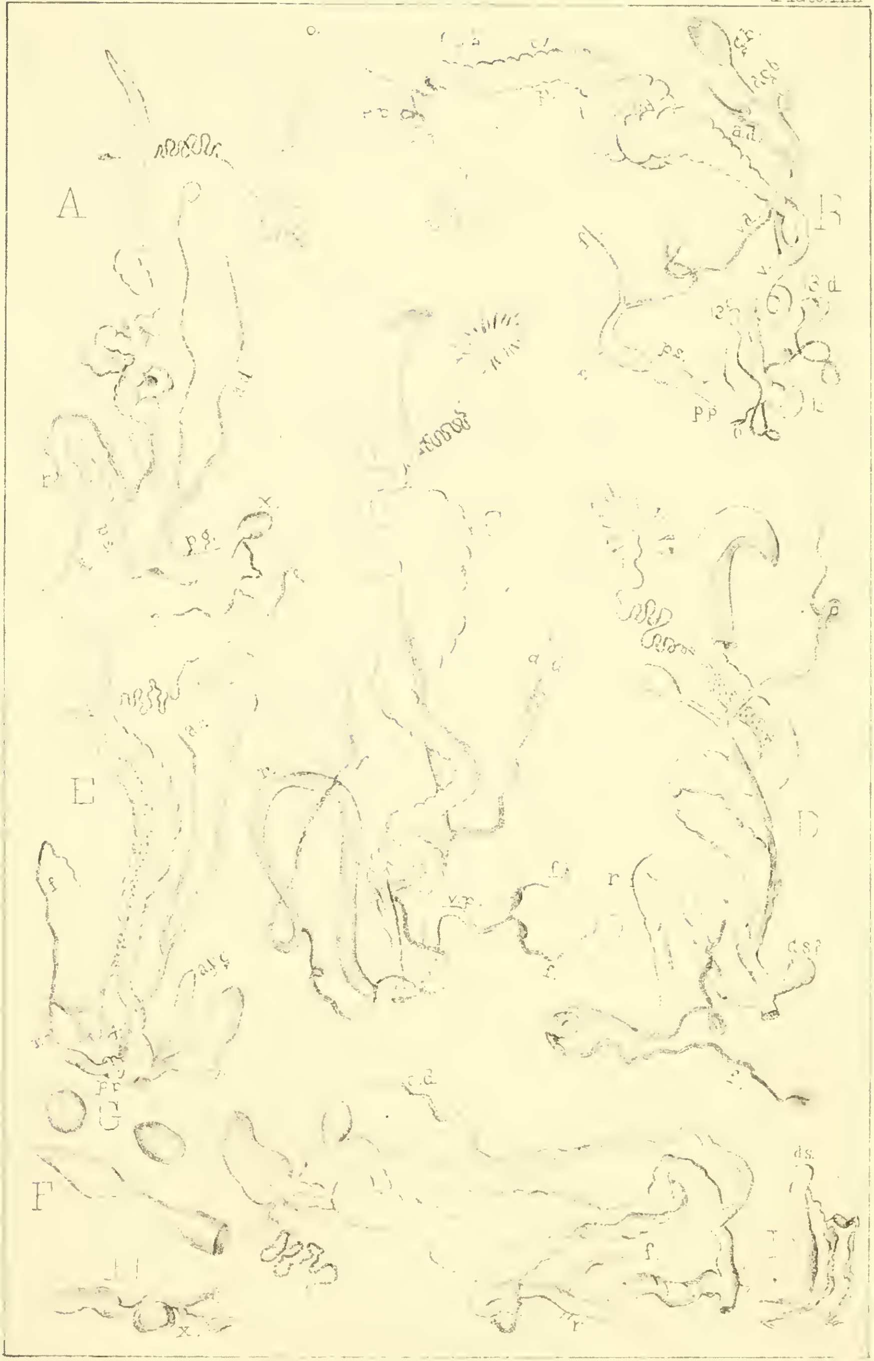
Plate XIII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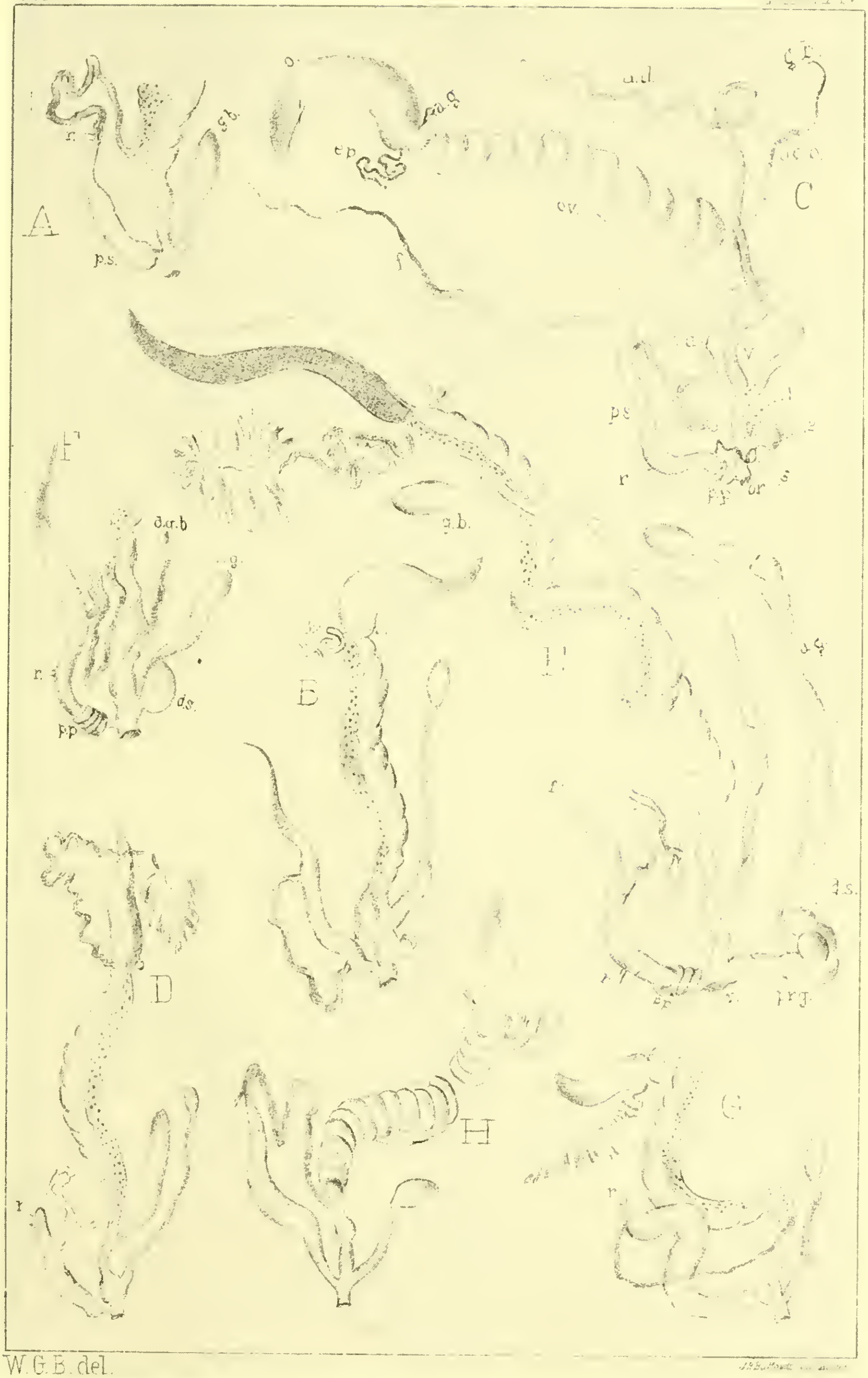
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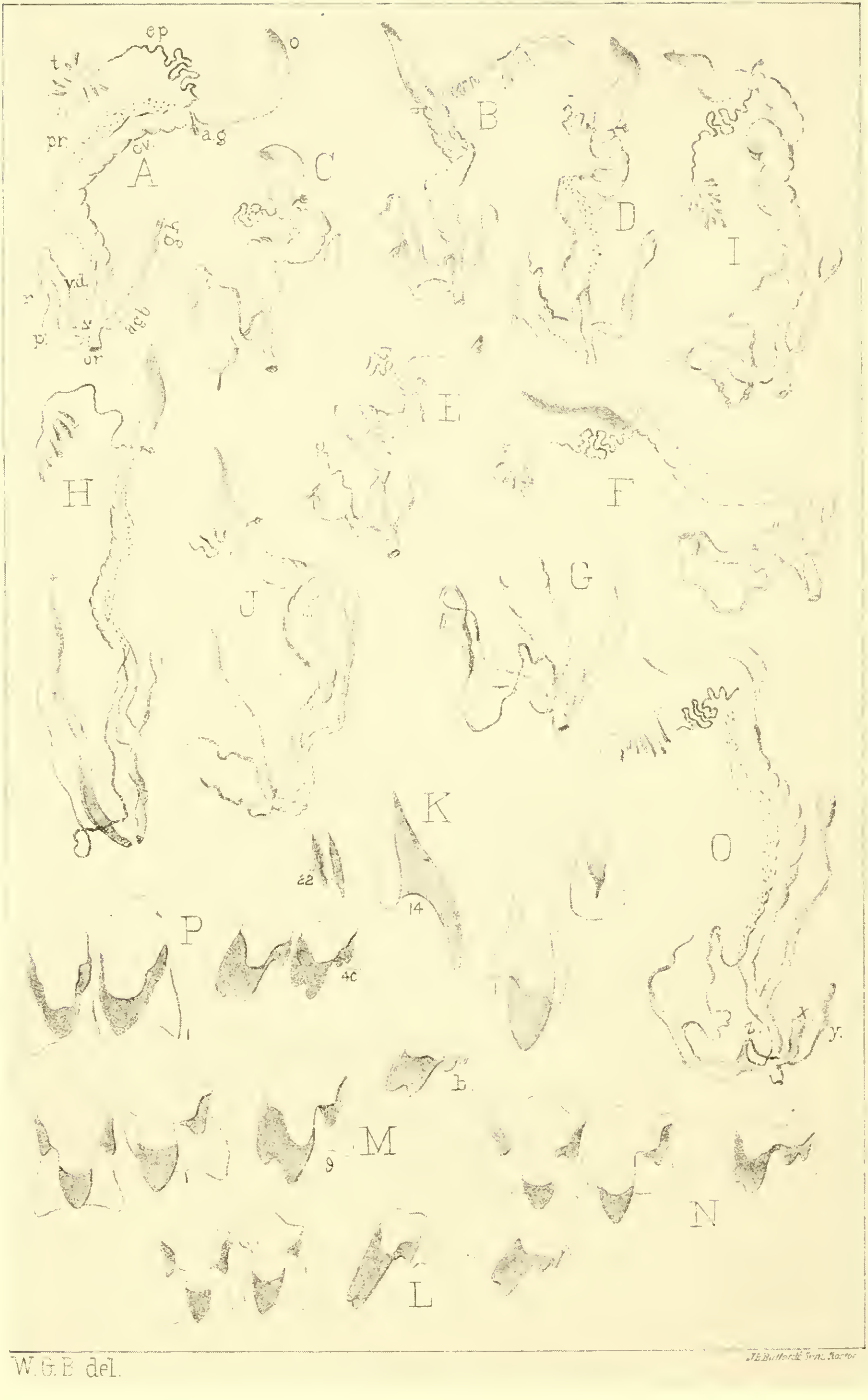
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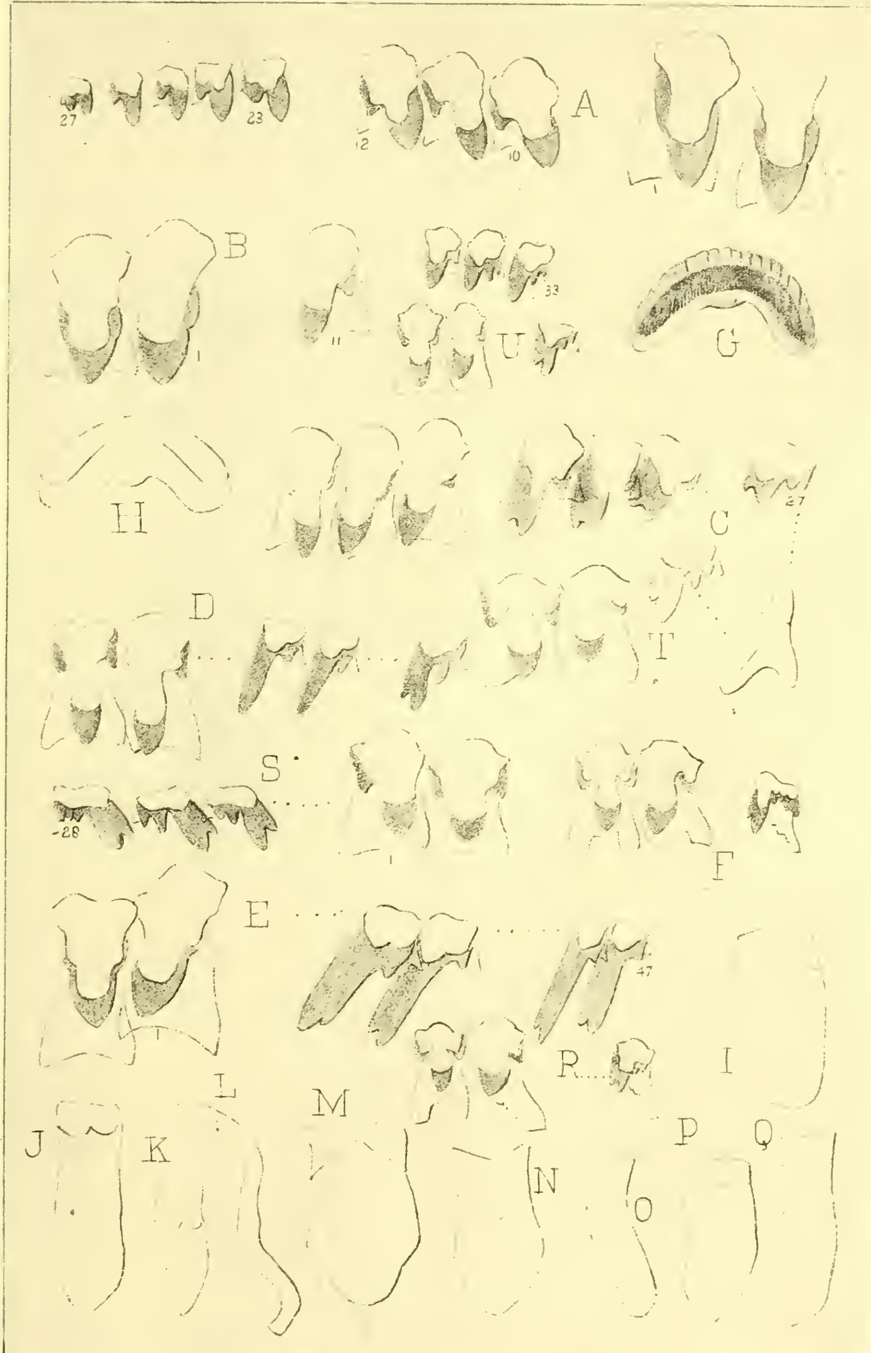
Vol V

Plate XVI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